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CIVIL ENGINEERING

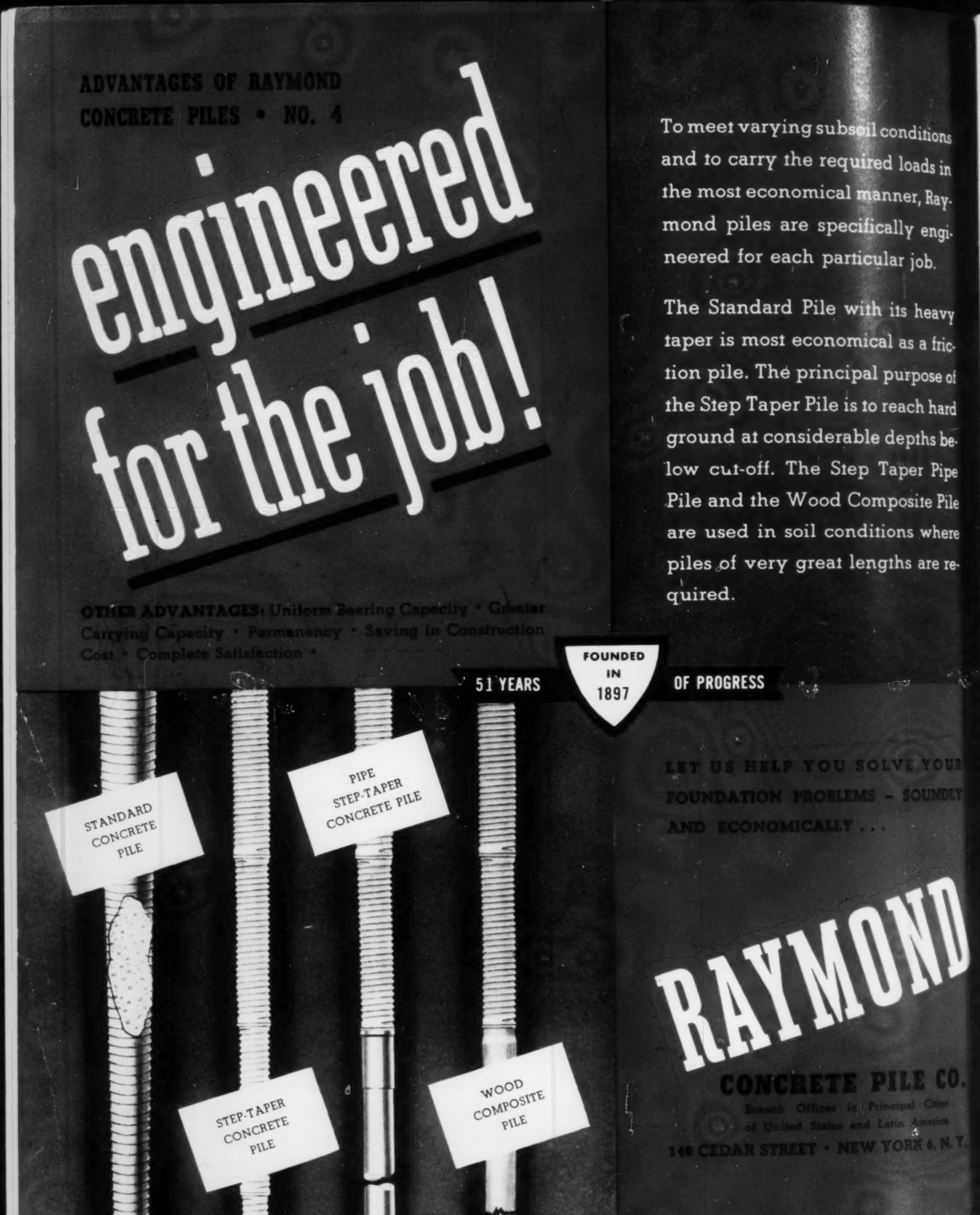
PENN-LINCOLN PARKWAY approaches Pittsburgh, Pa., from east via three-arch concrete bridge leading to eastern portal of Squirrel Hill Tunnel (to left). See symposium on Parkway, page 36.

enn-Lincoln Parkway Builders Solve Complex Design and Construction Problems
Schmidt, Richardson, Singstad, and Fuller

Mapping Proves Economical Expedient in Planning Growth of Large Cities
Earnell, Taylor and Kauffman

Broad Flood Control Program Aims to Regulate Northwest's Major Rivers—*Walsh*

ASCE ANNUAL MEETING—NEW YORK, N.Y.—JANUARY 19–21, 1949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To meet varying subsoil conditions and to carry the required loads in the most economical manner, Raymond piles are specifically engineered for each particular job.

The Standard Pile with its heavy taper is most economical as a friction pile. The principal purpose of the Step Taper Pile is to reach hard ground at considerable depths below cut-off. The Step Taper Pipe Pile and the Wood Composite Pile are used in soil conditions where piles of very great lengths are required.

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American Society of Civil Engineers 1949 Annual Meeting

New York, N.Y. HOTEL COMMODORE *January 19–21, 1949*

Registration: Ballroom Foyer, Commodore Hotel, 9:00 a.m., Wednesday, January 19

Ninety-Sixth Annual Business Meeting, Wednesday, January 19

10 A.M., EAST BALLROOM, COMMODORE HOTEL

Presiding: Richard E. Dougherty, President, American Society of Civil Engineers

10:00 **Annual Reports of Board of Direction, Secretary and Treasurer**

10:15 **Presentation of Awards**

The Norman Medal to ALFRED M. FREUDENTHAL, M. ASCE

The J. James R. Croes Medal to KARL DEVRIES, M. ASCE

The Thomas Fitch Rowland Prize to M. M. FITZHUGH, J. S. MILLER, and KARL TERZAGHI, Hon. M. ASCE

The James Laurie Prize to HYDE FORBES, M. ASCE

The Arthur M. Wellington Prize to JOSEPH BARNETT, M. ASCE

The Collingwood Prize for Juniors to JOHN K. VENNARD, Assoc. M. ASCE

The Daniel W. Mead Prize for Students to FRANK J. KERSNAR, Jun. ASCE

The Rudolph Hering Medal to C. E. JACOB, Assoc. M. ASCE

The J. C. Stevens Award to PRESTON T. BENNETT, M. ASCE

The Construction Engineering Prize to C. GLENN CAPPEL, Director, ASCE

The Leon S. Moisseiff Award to GEORGE WINTER, M. ASCE

10:45 **Presentation of John Fritz Medal to**

CHARLES METCALF ALLEN, M. ASCE, Professor, Hydraulic Engineering, Worcester Polytechnic Institute, Worcester, Mass.

11:00 **Presentation of Hoover Medal to**

MALCOLM PIRNIE, Past President, ASCE, Consulting Engineer, New York, N.Y.

11:15 **Conferring of Honorary Memberships**

CHARLES H. BUFORD, M. ASCE, President, Chicago, Milwaukee, St. Paul and Pacific Railroad, Chicago, Ill.

LUCIUS D. CLAY, M. ASCE, Lieutenant General, General Staff, U.S.A., Commander-in-Chief of American Forces in Europe.

DONALD DERICKSON, M. ASCE, Professor of Civil Engineering, Tulane University, New Orleans, La.

GANO DUNN, M. ASCE, President, The J. G. White Engineering Corporation, New York, N.Y.

ANDREW WEISS, M. ASCE, Construction Engineer, National Commission of Irrigation, Mexico, D.F., Mexico

11:45 **New Business**

Report of Tellers on Canvass of Ballot for Officers

Introduction of President-Elect and New Officers

12:15 **Adjournment for Membership Luncheon**

Sessions of Technical Divisions, Wednesday Afternoon

Structural Division

2:00 P.M. EAST BALLROOM

Presiding: John I. Parcel, Chairman, Executive Committee, Structural Division*

2:00 **Structural Damping in Suspension Bridges**

FREDERICH BLEICH,* Consulting Engineer, Frankland and Lienhard, and L. W. TELLER,* Principal Highway Engineer, Division of Physical Research, Public Roads Administration.

3:00 **The Plasticity of Metals—A Discussion of Mathematical Theory and Its Application to Engineering Problems**

D. C. DRUCKER,* Graduate School of Applied Mathematics, Brown University.

4:00 **Buckling Stresses for Flat Plates and Sections Made of Assembled Flat Plates**

ELBRIDGE Z. STOWELL, GEORGE J. HEIMERL, CHARLES LIBOVE,* and EUGENE E. LUNDQUIST,* National Advisory Committee for Aeronautics, Langley Field, Va.

Highway Division

2:00 P.M. GRAND BALLROOM

Presiding: Gibb Gilchrist, Chairman, Executive Committee, Highway Division*

SUBJECT: HIGHWAY ENGINEERING AS A CAREER

2:00 **Needs of Highway Engineering Education**

BEN H. PETTY,* Professor, Highway Engineering, Purdue University, Lafayette, Ind.

OUTLOOK FOR HIGHWAY ENGINEERING GRADUATES

2:30 (*a*) **As a Professional Man**

HAL H. HALE,* Executive Secretary, American Association of State Highway Officials, Washington, D.C.

2:50 (*b*) **As a Public Servant**

SAM C. HADDEN,* Consulting Engineer, Former Chairman, Indiana State Highway Commission, Indianapolis, Ind.

3:10 (*c*) **In the State Service**

D. C. GREER,* State Highway Engineer of Texas and Member of the Executive Committee of the American Association of State Highway Officials, Austin, Tex.

3:25 (*d*) **In the Government Service**

C. D. CURTISS,* Deputy Commissioner, Public Roads Administration, Washington, D.C.

Discussion

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*Members of the American Society of Civil Engineers.

Surveying and Mapping Division

2:00 P.M. **PARLORS B & C**

Presiding: G. Brooks Earnest, Member, Executive Committee, Surveying and Mapping Division*

PANEL DISCUSSION: PROPERTY SURVEYING, ITS CUSTOMS AND PROBLEMS

Ford Bartlett,* Lockwood, Kessler and Bartlett, Brooklyn, N.Y.

W. C. Wattles, Surveyor and Engineer, Glendale, Calif.

John P. Goggin, Surveyor and Engineer, Clare, Mich.

Clifford A. Betts, Surveyor and Engineer, Chattanooga, Tenn.

Discussion

Sanitary Engineering Division

2:00 P.M. **WEST BALLROOM**

Presiding: H. M. Freeburn, Chairman, Executive Committee, Sanitary Engineering Division*

2:00 Introductory Remarks

H. M. Freeburn,* Chief Engineer, Philadelphia Suburban Water Co., Bryn Mawr, Pa.

2:05 Cold Weather Sanitary Engineering Problems

W. A. Hardenbergh,* Editor, *Public Works Magazine*, New York, N.Y.

2:35 Discussion

2:45 Status and Opportunities for Sanitary Engineers in the Armed Services

Clarence W. Klassen, Chief Sanitary Engineer, Illinois Department of Publi Health, Springfield, Ill.

3:15 Discussion

3:25 Federal Water Pollution Contro Act, U. S. PHS Program

Mark D. Hollis,* Assistant Surgeo General, Chief Sanitary Engineer, U. S Public Health Service, Washington, D.C

3:50 Discussion

4:00 Federal Works Agency Program

J. W. Follin,* Assistant Administrator, Federal Works Agency, Washington D.C.

4:30 Discussion

Social Activities, Wednesday, January 19

MEMBERSHIP LUNCHEON

12:30 p.m. **Grand Ballroom—Commodore Hotel**

All members, their ladies, guests and friends of ASCE are cordially invited to attend. A keynote address is to be presented at this luncheon.

DINNER-DANCE

Grand Ballroom—Commodore Hotel

7:00 **Assembly** 7:45 **Dinner** 10:00 **Dancing**

Arrangements may be made for tables seating 10 persons. Members may underwrite complete tables. Orders for tables must be accompanied by a check in full and a list of guests.

Tickets will be $8.00 each. The seating list will close at 5:00 p.m. Tuesday, January 18. Tickets purchased after this hour will be assigned to tables in order of purchase. Sale of tickets will continue until 5:00 p.m. Wednesday, January 19. Tickets for Juniors for the Dance only will be $2.00 per couple.

Formal dress.

Sessions of Technical Divisions, Thursday Morning

Construction Division

9:30 A.M. **GRAND BALLROOM**

Presiding: Elmer K. Timby, Member, Executive Committee, Construction Division*

9:30 Construction Engineering Education—Present and Future

M. I. Evinger,* Chairman, Committee on Construction Engineering Education.

9:40 Teaching Aids for Construction Engineering Education

H. W. Richardson* and F. A. Nikirk,* Members, Committee on Construction Engineering Education.

9:50 Discussion

10:00 Construction Organization and Functions for Awarding Agency

John C. Page,* Former Commissioner, Bureau of Reclamation.

10:00 Construction Engineering—Organization and Management of Construction Enterprise from the Viewpoint of Contractor and Construction Engineer

Robert W. Briggs,* Consulting Engineer, New Rochelle, N.Y.

11:30 Discussion

Note: Construction luncheon to follow this session in Grand Ballroom.

Sanitary Engineering Division

9:30 A.M. **WEST BALLROOM**

Presiding: H. M. Freeburn, Chairman, Executive Committee, Sanitary Engineering Division*

9:30 Report of the Committee on Rates and Rate Structures for Water and Sewage Works

S. A. Greeley,* Consulting Engineer, Greeley and Hansen, Chicago, Ill.

10:00 Discussion

10:10 Report of the Committee on Advancement of Sanitary Engineering

Herman G. Baity,* Professor of Sanitary Engineering, University of North Carolina.

10:40 Discussion

10:50 Problems of Nuclear Fission Operations and the Sanitary Engineer

Arthur E. Gorman,* Sanitary Engineer, U. S. Atomic Energy Commission, Washington, D.C.

11:10 Discussion

11:20 Report of the Committee on Wate Supply Engineering

Thomas H. Wiggin,* Consulting Engineer, New York, N.Y.

12:00 Discussion

Soil Mechanics and Foundations Division

9:30 A.M. **ROOMS B AND C**

Presiding: Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division*

SYMPOSIUM SPONSORED BY COMMITTEE ON EARTH DAMS

Introductory Remarks

William P. Creager,* Chairman, Committee on Earth Dams

Transient Flow

Philip C. Rutledge,* Chairman, Subcommittee on Seepage and Drainage

Consolidation of Materials in Earth Dams

Robert R. Philippe,* Chairman, Subcommittee on Consolidation of Materials in Earth Dams and Their Foundations

Slope Protection and Effect of Waves on Riprap

Martin A. Mason,* Member, Subcommittee on Slope Protection

Note: Symposium continued in afternoon session.

Structural Division

9:30 A.M. EAST BALLROOM

Presiding: John I. Parcel, Chairman, Executive Committee, Structural Division*

9:30 **Approximation in Rigid-Frame Analysis**

L. T. Wyly,* Professor, Structural Engineering, Purdue University.

10:00 **Lateral Buckling of Eccentrically Loaded Columns**

H. N. Hill,* and J. W. Clark,* Research Laboratories Aluminum Company of America, New Kensington, Pa.

11:00 **A Study of the Effects of Heating and Driving Conditions on Hot-Driving Structural Steel Rivets**

R. A. Hechtman,* Department of Civil Engineering, University of Illinois, Urbana, Ill.

Social Activities, Thursday, January 20

12:30 p.m. **Construction Luncheon—Grand Ballroom—Commodore Hotel**

Annual Luncheon sponsored by Construction Division of ASCE.

Panel Discussion:

Construction Prospects for 1949

See Construction Division Program for speakers.

Tickets: $3.50 each.

3:45 p.m. **Reception, Tea and Entertainment for Ladies**

Century Room—Commodore Hotel

A show of special interest, "Fit and Fair," will be presented. Door Prize and refreshments. Tickets, $2.50 each.

8:00 p.m. **Men's Smoker and Entertainment**

Grand Ballroom—Commodore Hotel

An informal evening, with ample opportunity to greet your old friends and make new acquaintances, is planned.

Entertainment—Refreshments—Smokes—Bar. Tickets, $2.00 each.

Sessions of Technical Divisions, Thursday Afternoon

City Planning Division

2:00 P.M. EAST BALLROOM

Presiding: Frank H. Malley, Chairman, Executive Committee, City Planning Division*

2:00 **National Security Factors in Industrial Location**

Dario S. Barozzi, Consultant, National Security Resources Board, Washington, D.C.

2:20 **Discussion**

Lawrence V. Sheridan,* Member, Executive Committee, City Planning Division.

Tracy B. Augur, Assistant to Director, Regional City's Department, Tennessee Valley Authority, Knoxville, Tenn.

2:40 **General discussion**

Power Division

2:00 P.M. PARLOR A

Presiding: A. T. Larned, Chairman, Executive Committee, Power Division*

Papers sponsored by Joint Commitee on Masonry Dams

World-Wide Dam Construction

A. V. Karpov,* Consulting Engineer, Pittsburgh, Pa.

Power Development in the Philippine Islands

F. C. Rodriguez,* Manager, National Power Corp., Manila, P.I.

Report on Meeting of International Congress on Large Dams in Stockholm, Sweden

Joel D. Justin,* Power Division Representative, Consulting Engineer—Justin & Courtney, Philadelphia, Pa.

Illustrated Description of European Trip to Congress on Large Dams

Francis S. Friel,* President and Treasurer, Albright & Friel, Inc., Philadelphia, Pa.

Sanitary Engineering Division

2:00 P.M. WEST BALLROOM

Presiding: H. M. Freeburn, Chairman, Executive Committee, Sanitary Engineering Division*

2:00 **The Delaware Water Supply System of the City of New York**

Roger W. Armstrong,* Chairman, Board of Engineering Consultants, Board of Water Supply, City of New York, N.Y.

2:50 **Discussion**

3:00 **Industry and Its Waste Treatment**

L. L. Hedgepeth, Executive Secretary, Virginia Water Control Board, Richmond, Va.

3:40 **Discussion**

3:50 **Control of Water Resources by Zoning**

Howard T. Critchlow,* Chief Engineer, Division of Water Policy and Supply, New Jersey Department of Conservation, Trenton, N.J.

4:25 **Report of the Committee on Refuse Collection and Disposal**

Rolf Eliassen,* Professor of Sanitary Engineering, New York University.

Soil Mechanics and Foundations Division

2:00 P.M. PARLORS B AND C

Presiding: Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division*

SYMPOSIUM ON EARTH DAMS
(Continued)

Circular Arc Method of Design of Earth Dams

Donald W. Taylor,* Chairman, Subcommittee on Design of Earth Dams and Their Foundations.

Pore-Water Pressures

Ralph B. Peck,* Chairman, Subcommittee on Measurement of Pore Water Pressures in Earth Dams and Their Foundations.

The Time Lag in Observation of Groundwater Levels and Pressures

M. Juul Hvorslev,* Consultant, Waterways Experiment Station, Corps of Engineers, Vicksburg, Miss.

Discussion

Construction Division

1:30 P.M. GRAND BALLROOM

Continuation of Panel Discussion of Construction Luncheon

CONSTRUCTION PROSPECTS FOR 1949

Presiding: Elmer K. Timby, Member, Executive Committee, Construction Division*

1:30 **Definition of Subject**

Elmer K. Timby,* Professor, Civil Engineering, Princeton University.

Private Construction

Charles B. Spencer,* President, Spencer, White & Prentis, New York, N.Y.

Public Construction

W. E. Reynolds,* Commissioner of Public Buildings, Washington, D.C.

Foreign Construction

Kirby Smith,* Vice-President, Raymond Concrete Pile Co., New York, N.Y.

Materials of Construction

M. H. Baker, National Gypsum Co.

Labor

Donald A. McCabe, Professor of Economics, Princeton University.

Equipment

A. H. Ayers,* Utah Construction Co., San Francisco, Calif.

Summary—Planning to Be Done

Waldo G. Bowman,* Editor, *Engineering News-Record*, New York, N.Y.

Sessions of Technical Divisions, Friday Morning

Power Division

9:30 A.M. WEST BALLROOM

Presiding: A. T. Larned, Chairman, Executive Committee, Power Division*

PAPERS BY COMMITTEE ON PROGRESS IN POWERPLANT DESIGN

New Trends in Hydroelectric Power Plant Design

W. S. Merrill,* and M. G. Salzman,* Hydraulic Engineers, Ebasco Services, Inc.

Welded Penstock Design and Construction for Hydro Plants

Peter J. Bier, U.S. Bureau of Reclamation, Denver, Colo.

Discussion

I. E. Boberg, Chief Engineer, Chicago Bridge & Iron Co., Chicago, Ill.

Ross, Riegel,* Head Civil Engineer, TVA, Knoxville, Tenn.

Air Transport Division

9:30 A.M. PARLORS B AND C

Presiding: A. J. Ryan, Chairman, Executive Committee, Air Transport Division*

Air Traffic Problems of the New York Region

C. Earl Morrow, Chief Planning Engineer, Regional Planning Association, New York, N.Y.

Airport Program of the Port of New York Authority

J. C. Evans,* Chairman, Engineering Board, Port of New York Authority.

Maintenance of La Guardia Airport as a Continuing Operating Terminal

J. M. Kyle, Chief Engineer, Port of New York Authority.

Terminal Design—International and Domestic Airway Transportation

J. M. Sullivan, Engineer of Airports, Port of New York Authority.

City Planning Division

10:00 A.M. EAST BALLROOM

Presiding: Leslie Williams, Secretary, Executive Committee, City Planning Division*

PANEL DISCUSSION—NEIGHBORHOOD APPROACH TO PLANNING

10:00 **Street Systems**

Hugo Winter,* Member, Executive Committee, City Planning Division.

10:10 **Schools and Recreation**

John M. Picton,* Member, Executive Committee, City Planning Division.

10:20 **Housing and Development Projects**

Louis Wetmore, Director, Redevelopment Commission, Providence, R.I.

10:30 **Shopping and Business Centers**

Myron Hendee,* Land Planning Consultant, Federal Housing Administration.

10:40 **General Discussion**

11:40 **Conclusion**

Lawrence V. Sheridan,* Member, Executive Committee, City Planning Division.

Waterways Division

9:30 A.M. GRAND BALLROOM

Presiding: W. H. Smith, Chairman, Executive Committee, Waterways Division*

New York City's Pier Rehabilitation Program

Capt. E. A. Verpillot,* Deputy Chief Engineer, Department of Marine and Aviation, City of New York, N.Y.

Sedimentation in Harbors

Joseph M. Caldwell,* Beach Erosion Board, Washington, D.C.

Design of the Harbor and Terminal Facilities at Amuay Bay, Venezuela

Theodore T. Knappen,* Knappen Tippetts Abbett Engineering Co., New York, N.Y.

Joint Sessions of Sanitary Engineering Division with New York State Sewage Works Association and American Water Works Association

FRIDAY, JANUARY 21 HOTEL PENNSYLVANIA

10:30 **Technical Sessions arranged by the New York State Sewage Works Association**

The Effect of Sea Water on the Biochemical Oxidation of Sewage

Harold B. Gotaas, Professor of Sanitary Engineering, University of California, Berkeley, Calif.

11:00 **A Novel High-Rate Anaerobic Waste Treatment System**

Harry W. Gehm, Technical Adviser, National Council for Stream Improvement, New York, N.Y., and

Philip F. Morgan, formerly chief development engineer, National Council for Stream Improvement, now Associate Professor of Sanitary Engineering, University of Iowa.

11:30 **Discussion**

Eugene H. Trubnick, sanitary chemist, Anheuser-Busch, Inc., Old Bridge, N.J.

11:45 **A Report on Plans and Progress for the Tenth Edition of Standard Methods**

Harry A. Faber, Chairman, Joint Editorial Board.

12:15 **Joint Luncheon, Grand Ballroom, Hotel Pennsylvania.**

Tickets on sale at Registration Desks of ASCE, Hotel Commodore and N.Y.S.-S.W.A. at Hotel Pennsylvania until 10 a.m., January 21.

Presentation of Awards

Guest Speaker

HON. HAROLD C. OSTERTAG, Chairman, Joint Legislative Committee on Interstate Cooperation, State of New York.

Pollution Control Legislation in New York State

3:00 **Technical Session**
Toward a Unified Plumbing Code
(with film)

FRANCIS B. ELDER, engineering associate, The American Public Health Association, New York, N.Y.

3:30 **The Federal Works Agency and Water Pollution Control**

MAJ. GEN. PHILIP B. FLEMING, Administrator, Federal Works Agency, Washington, D.C.

4:00 **The 26th Ward Sewage Treatment Works, Brooklyn, N.Y.**

S. W. STEFFENSEN, Project Manager and Deputy Chief, Bureau of Sewage Disposal Design, Department of Public Works of the City of New York.

5:00-6:00 **Social Hour**

Manhattan Room—Hotel Pennsylvania

Courtesy of the Water and Sewage Works Manufacturers Association, Inc.

Saturday, January 22

9:00 **Inspection—26th Ward Sewage Treatment Works, Brooklyn, N.Y.**

Student Chapter Conference

FRIDAY, JANUARY 21
GRAND BALLROOM

Annual Conference sponsored by Metropolitan Conference of Student Chapters

Presiding: William Mulder, Chairman of Conference

2:00 **Welcome by Chairman Mulder**

2:05 **ASCE and You**

FRANKLIN THOMAS,* President, ASCE.

2:15 **Forum on Job Opportunities in Civil Engineering**

Stress Analysis in Aircraft

S. F. BORG,* Assistant Professor of Aeronautics, U. S. Naval Postgraduate School.

Traffic Engineering

LESLIE WILLIAMS,* Consultant, Leslie Williams, Associates.

Design and Construction of Petroleum Refining Equipment

HERBERT SCHUSTER, Chief Designer, M. W. Kellogg Co.

3:45 **Forum on Student Chapter Affairs**

Students are welcome to all events of the Annual Meeting.

Excursion, Friday Afternoon

Leave Hotel Commodore by bus. A sightseeing expedition will visit the Lincoln Tunnel under the Hudson River, express highways in New Jersey, the Pulaski Skyway, industrial areas of New Jersey and feature a conducted tour through the Johns Manville plant and research laboratories at Manville, N.J.

Tickets for members and guests, $2.00 each.

Cooperative Session

of
United States Council of the International Association for Bridge and Structural Engineering
FRIDAY, JAN. 21—10:00 A.M.
HOTEL COMMODORE, PARLOR A

College Reunions Scheduled

City College of New York

The Dam Club will meet at the Thursday Construction Luncheon. A welcome is extended to all graduates of City College. Contact Bruno Caneva, Central Cement Finishing Co., Room 729, 101 Park Ave., New York City.

Clarkson College of Technology

Annual Dinner of the New York Section of the Alumni Society of Clarkson will be held at the Hotel Astor on the evening of January 22.

Cornell Society of Engineers

The Cornell Society of Engineers will hold a meeting on Thursday evening, January 21, at 8:00 p.m. in the Cornell Club at 107 East 48th Street. The speaker will be Dr. N. A. Christensen, new Director of Engineering at Cornell. It has been planned to have this meeting coordinated with the ASCE Smoker so that those interested can attend both events.

Massachusetts Institute of Technology

The M.I.T. Club of New York is again sponsoring a lunch for civil engineering graduates who are members of ASCE. This has been and is again expected to be a very enjoyable and successful event in the Annual Meeting program. Prof. John B. Wilbur, head of the Civil and Sanitary Engineering Department of M.I.T., will be the principal guest. Prof. Charles B. Breed and several active professors in the department will also be present. There will be an informal discussion of the latest activities of the Civil Engineering Department at M.I.T. as well as of the part being played by its graduates in the profession. The lunch will be held in the South Room of the Hotel Commodore at 12:30 p.m. on Thursday, January 20, 1949. For further information, contact the luncheon chairman, William H. Correale, PLaza 7-8001.

Rutgers University

Rutgers University Civil Engineering Alumni will meet for their annual dinner at 6:30 p.m. on Thursday, January 20. This will be an opportunity to see your college mates and later attend the ASCE Men's Smoker.

Hotel Accommodations and Meeting Headquarters

Headquarters for the Annual Meeting will be the Hotel Commodore adjacent to Grand Central Terminal in New York City. Special arrangements have been made to accommodate convention visitors at the Headquarters Hotel. A special reservations form to assure accommodations is provided for your use. See page 92. Send this form in early. Late reservations may have to be assigned to other nearby hotels.

Information and Registration Desk

An information and registration desk will be maintained on the Ballroom Foyer at the Headquarters Hotel from 9 a.m., Wednesday, January 19, to Friday noon, January 21. Mail and messages will be held for members at the Information Desk.

Ladies Headquarters

The club suite on the third floor of the Hotel Commodore has been reserved as Ladies Headquarters for the duration of the Annual Meeting. There the ladies will find a convenient place for meeting their friends, planning their activities, playing bridge, etc. Members of the Ladies' Committee will be on duty to assist with advice on shopping and sightseeing. The ladies are invited to make full use of their headquarters.

Committees for Annual Meeting

Edward J. Cleary, *General Chairman*
John P. Riley, *Vice-Chairman*
Maurice N. Quade, *Past-Chairman*
William McK. Griffin, *Board Contact Member*

Wednesday Luncheon Committee

Irving F. Ashworth, *Chairman*
J. M. Garrelts
S. Ralph Angell

Dinner-Dance Committee

Nomer Gray, *Chairman*
R. A. Brandes
Ford Bartlett

Ladies Entertainment Committee

William S. LaLonde, *Chairman*
Irving Ashworth
Horace A. Vanderbeek

Men's Smoker Committee

John M. Buckley, *Chairman*
Ralph W. Atwater
J. M. Garrelts

Excursion Committee

Charles B. Molineaux, *Chairman*
Eugene M. Itjen
Horace A. Vanderbeek
S. Ralph Angell

Ladies' Committee

Mrs. E. J. Cleary, *Chairman*
Mrs. J. P. Riley, *Vice-Chairman*
Mrs. M. N. Quade
Mrs. R. W. Armstrong
Mrs. R. W. Atwater
Mrs. R. L. Brandes
Mrs. F. Bartlett
Mrs. A. Hedefine
Mrs. I. V. A. Huie
Mrs. E. M. Itjen
Mrs. W. S. LaLonde
Mrs. J. M. Buckley
Mrs. W. N. Carey
Mrs. J. M. Garrelts
Mrs. M. Goodkind
Mrs. N. Gray
Mrs. W. McK. Griffin
Mrs. S. Hardesty
Mrs. C. B. Molineaux
Mrs. W. J. Shea
Mrs. C. E. Trout
Mrs. H. A. Vanderbeek

CONCRETE SPILLWAY OF DORENA DAM, unit of Willamette Valley Flood Control Project, is shown under construction on right bank of Row River, Oregon. Air view looking upstream shows project 63 percent complete. Concrete sections of dam, which include spillway, form juncture between high right bank of river and rolled earth embankment extending across flood plain. Dam has total length of 3,388 ft and rises about 140 ft above river channel. Family housing facilities, part of which appear at right, were moved on special trailers from McLoughlin Heights in Vancouver, Wash., 250-odd miles away. Guy F. Atkinson Co., contractors on $14,000,000 project, estimate completion in October 1949, nine months ahead of schedule.

Regulation of Northwest's Major Rivers Is Aim of Broad Flood Control Program

Work Progresses on Dams in Willamette Project as Corps of Engineers Presents Comprehensive Columbia Basin Program

O. E. WALSH

Colonel, Corps of Engineers; District Engineer, Portland, Ore.

TWO DAMS COMPLETED, two under construction, and a fifth about to be advertised for bids—this is the present status of the Willamette Valley Flood Control Project, designed to protect an area almost as large as Holland, the fertile Willamette Valley in Oregon. Many different types of work of interest to engineers are going forward in the valley, such as railroad and highway relocation, construction camp housing, dam construction on concrete and earthfill structures, high- and low-head power installations, bank protection works, and dredging. The costly 1948 flood on the Columbia River—second largest of record—hastened the formulation of a long-range plan for flood protection on the entire Columbia system. Results of comprehensive studies by the Corps of Engineers have just been issued in a "308" Review Report. This article has been prepared from the paper presented by Col. Walsh before the Construction Division at the Society's Seattle Convention.

NEARLY EVERY TYPE of construction activity and a great variety of construction problems are represented in the Willamette River Flood Control Project, adopted by Congress in June 1938, as the result of the comprehensive report prepared by the Corps of Engineers on Congressional authorization (Fig. 1). This multiple-purpose project has three main parts: (1) Construction of reservoirs for regulation of stream flow in the interest of flood control, irrigation, navigation, power development, and stream purification; (2) improvement of the navigable channel between Oregon City and Albany, Ore.; and (3) reconstruction of the locks passing navigation around Willamette Falls at Oregon City.

Units Included in Project

Congress appropriated sufficient funds to initiate some of these improvements, and the Fern Ridge Dam on the Long Tom River and Cottage Grove Dam on the Coast Fork have been constructed. Land acquisition, railroad and highway relocation for Dorena Dam and reservoir were initiated and partially completed when the war stopped all civil construction. When the Japanese struck Pearl Harbor four additional dams and reservoirs were authorized and were under study at the following locations: Lookout Point on the Middle Fork, Quartz Creek on the McKenzie, Sweet Home on the South Santiam, and Detroit on the North Santiam.

Although the Corps of Engineers was busy with military and industrial plant construction during the war, civil planning was not stopped entirely. Work on the railroad and highway relocation necessitated by the proposed construction of Dorena Dam was resumed in June 1946, and construction of the dam and spillway was initiated in the spring of 1947. Preliminary work was also initiated in the spring of 1947 on the Lookout Point and Detroit Dams.

Because of changed conditions since the original surveys, a review report has been submitted by the Portland District Engineer. In place of one dam proposed at the Quartz Creek site near Blue River on the McKenzie River, the following three dams are recommended: Gate Creek Reservoir on Gate Creek, Blue River Reservoir on Blue River, and Cougar Reservoir on the South Fork of the McKenzie River.

In place of the proposed Sweet Home Dam on the South Santiam, the following three dams are recom-

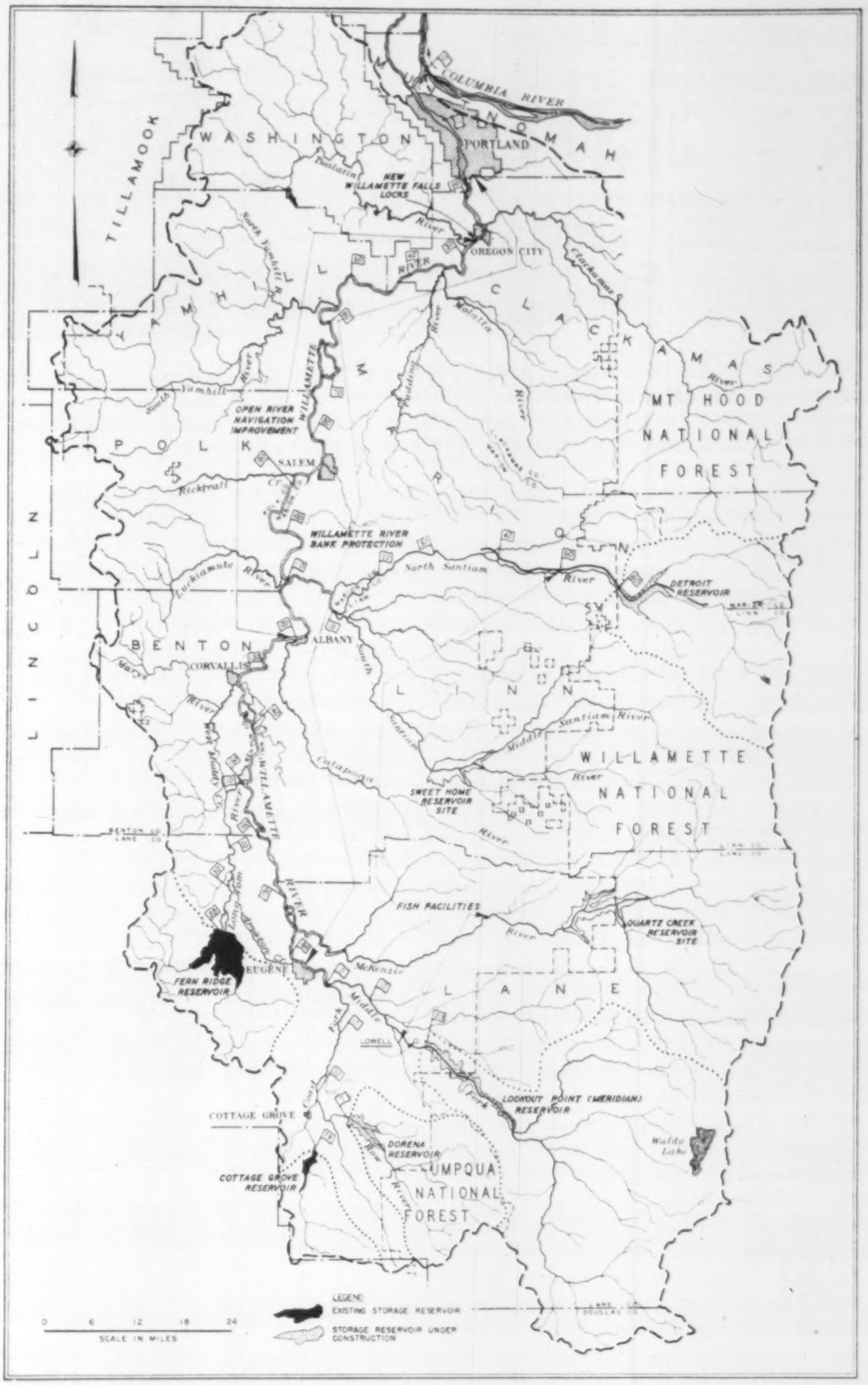

COLUMBIA RIVER
MULTNOMAH
PORTLAND
WASHINGTON
TILLAMOOK
NEW WILLAMETTE FALLS LOCKS
OREGON CITY
YAMHILL
CLACKAMAS
MARION
MT HOOD NATIONAL FOREST
POLK
OPEN RIVER NAVIGATION IMPROVEMENT
SALEM
WILLAMETTE RIVER BANK PROTECTION
North Santiam River
DETROIT RESERVOIR
LINCOLN
BENTON
CORVALLIS
ALBANY
LINN
WILLAMETTE NATIONAL FOREST
SWEET HOME RESERVOIR SITE
FISH FACILITIES
QUARTZ CREEK RESERVOIR SITE
EUGENE
FERN RIDGE RESERVOIR
McKenzie
LANE
LOWELL
LOOKOUT POINT (MERIDIAN) RESERVOIR
COTTAGE GROVE
DORENA RESERVOIR
COTTAGE GROVE RESERVOIR
UMPQUA NATIONAL FOREST
Waldo Lake
LEGEND
EXISTING STORAGE RESERVOIR
STORAGE RESERVOIR UNDER CONSTRUCTION
0 6 12 18 24
SCALE IN MILES

FIG. 1. WILLAMETTE VALLEY Flood Control Project, under construction by Corps of Engineers, includes dams and reservoirs shown, plus projected developments at several other sites. Willamette Valley, with total drainage area of 11,200 sq miles, has flat and fertile floor covering 3,500 sq miles. Uneven precipitation of 40- to 100-in. annual rainfall causes summer droughts followed by high water in fall, winter, and spring, presenting constant flood threat.

mended: Green Peter Reservoir on the Middle Santiam, east of Foster; Wiley Creek Reservoir on Wiley Creek, south of Foster; and Cascadia Reservoir on the Upper South Santiam River, above Sweet Home.

New reservoirs are also proposed at the following locations: Holley Reservoir on the Calapooya River, Tum Tum Reservoir on the Tum Tum River, Lewisville Reservoir on the Little Luckiamute River, Hills Creek Reservoir on Hills Creek, Dexter Reservoir on the Middle Fork of the Willamette, Fall Creek Reservoir on Fall Creek, White Bridge Reservoir on Middle Quartzville Creek, and Big Cliff Reservoir on the North Santiam River.

Wide Variety of Construction Work

The construction problems involved in this work may be divided into the following six categories:

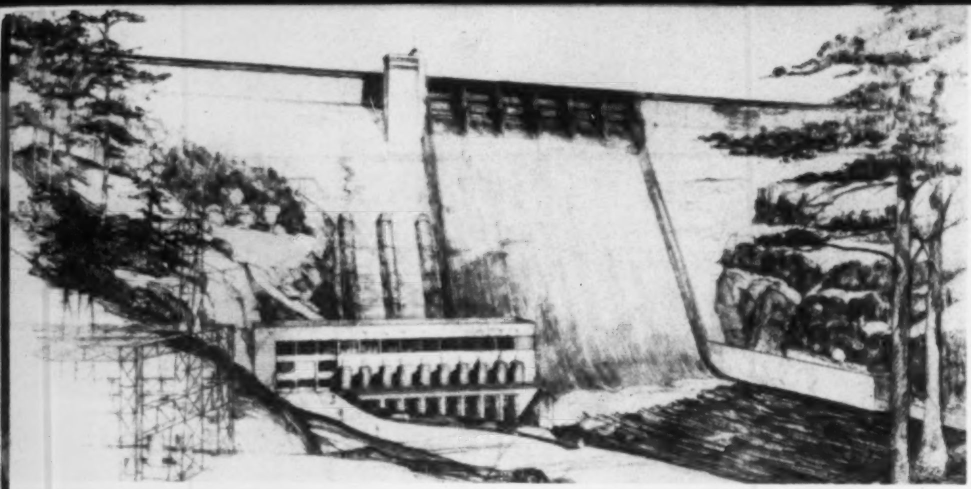
1. Housing projects for construction workers and government engineers and inspectors, involving the construction of all utilities such as streets and roads, electrical distribution systems, water supply and distribution, and the provision of sewers and sewage treatment plants.
2. Highway and railroad relocation necessitated primarily by the construction of dams, presenting unusual problems because of the rugged terrain.
3. Dam construction involving concrete structures and earthfills of various types which must be placed during a short working season.
4. Powerplant construction for both high- and low-head projects.
5. Bank protection works of various types including drift barriers.
6. Dredging work utilizing both pipeline and bucket-type dredges.

Surplus War Housing Utilized

Essentially all buildings on Willamette projects have been provided by moving surplus war housing and other facilities to the sites and remodeling them to serve their new purposes. The design and layout of all the construction camps were prepared under Architect-Engineer contracts with local engineers and architects. Family housing at Dorena Dam came mainly from McLoughlin Heights in Vancouver, Wash. The two- and three-bedroom houses were cut in half and moved on special trailers the 250 odd miles to Dorena Dam where they were set on new foundations, provided with utility connections, repainted and promptly occupied. This method provided the needed facilities quickly and with a minimum of work.

Offices, laboratory, messhall, dormitories, and concession buildings for the Dorena Dam camp were moved from the Corvallis Army Air Base and Camp Ridge Road in panels and reassembled at the site in various new forms. A part of this work was done with government plant and hired labor as the low bid was considered excessive. The work so done was completed at less than the government estimate.

At Meridian Dam housing facilities and utilities are still under construction. As at Dorena they will be largely reconstructed wartime housing and facilities adapted to the needs of the project. Additions are being made to the local community's grade and high schools and the schools are



ONE OF MAIN UNITS in Willamette Valley Project is Detroit Dam on North Santiam River, designed as straight gravity structure, including spillway and abutment sections. Total length is 1,580 ft, and issuance of bid invitations is expected in spring of 1949 for construction in single step to full height of 448 ft above lowest excavation.

being tied into the water supply and sewer system of the housing project. This work is necessary as the community otherwise would be unable to absorb the load placed on its school system by the influx of construction workers' families.

In the field of railroad relocation, the chief work now under way is the relocation of the main line of the Southern Pacific Railroad around Meridian Dam. The relocation starts about 8 miles below the dam in order to climb above the dam crest at a grade not exceeding the present controlling grade. Piers and abutments for the bridges across the Middle Fork Willamette River are completed and two large contracts for grading are under way. A third grading job is out for bids and two other large jobs will be advertised this year. These jobs are not unusual except that the Lost Creek fill involves a very large reinforced concrete multiple-arch culvert and the fill itself at its maximum height is just over 100 ft deep. In certain areas it has been necessary to remove clay which occurs in the fill foundation, and in other areas the foundation has been spread to insure stability with an adequate factor of safety. Work on existing contracts is well organized and proceeding well despite a very wet season to date which has made grubbing and the placing of fill difficult. Unusual construction problems met with in relocating the highway around the Detroit Dam on the North Santiam River were described by J. F. Cameron in CIVIL ENGINEERING for August 1948, page 40.

Placing Fill for Dorena Dam

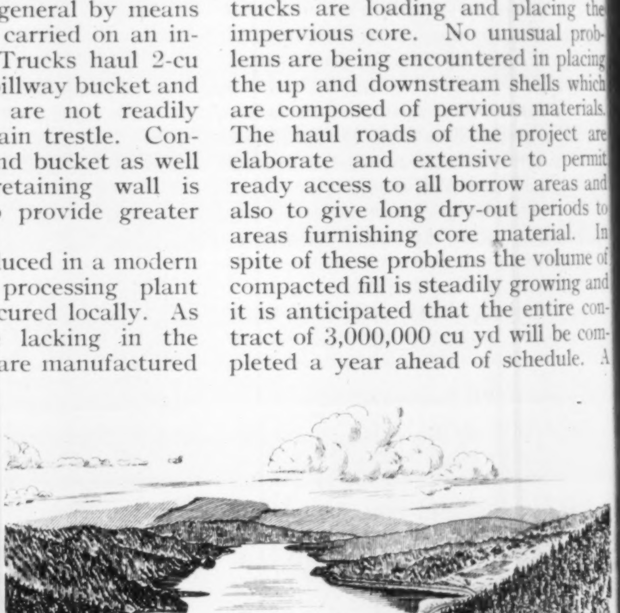
Dorena Dam is a rolled earthfill dam with a gravity type concrete spillway in which the flood control outlets are installed. Concrete is being placed on the downstream face of the spillway from a steel construction trestle. Type IV cement, with a maximum of 0.6 percent alkali content, is being used with an air-entraining admixture. The interior mass concrete contains 0.75 bbls per cu yd, the surface concrete, 1 bbl; yet it is readily workable and is of high durability. Both mass and surface concrete develop full strength slowly, 3,000 psi being attained in about 90 days. Placing at temperatures in excess of 70 deg F is not permitted. A most modern fully automatic and recording batching and mixing plant with two 2-cu yd mixers is provided. Distribution to the spillway structure is accomplished in general by means of 4-cu yd buckets carried on an industrial railroad. Trucks haul 2-cu yd buckets to the spillway bucket and wing walls which are not readily accessible to the main trestle. Concrete in the ogee and bucket as well as that in the retaining wall is vacuum treated to provide greater durability.

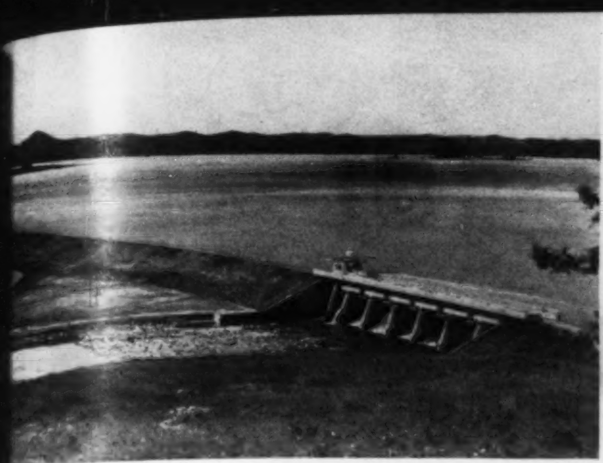
Aggregate is produced in a modern sand and gravel processing plant using materials procured locally. As sufficient fines are lacking in the natural sand, they are manufactured in the plant by means of a short con crusher and a ball mill. The resulting fine aggregate, a combination o natural and manufactured, falls easily n the range allowed for the fineness modulus.

Since the season for placing the earthfill at Dorena Dam is limited, special means have been taken to make the borrow areas drain readily by constructing a system of deep drainage ditches. Even with the ditches, it is a serious problem to secure impervious core material with proper moisture content. Many methods of borrow scarifying and loading have been tried to secure impervious materials with proper moisture content but so far most of these methods have not proved entirely satisfactory. Material provided by deep disking tended to form hard balls with excessively wet interiors which have been difficult to compact; and light harrowing resulted in materials that were too dry and required much sprinkling to secure proper compaction.

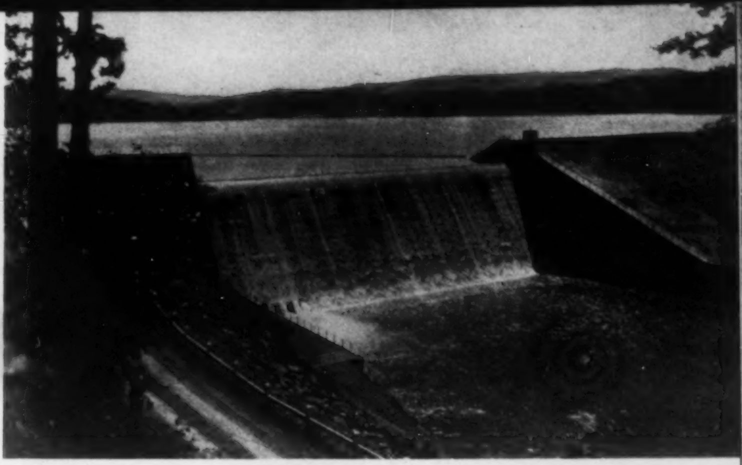
Last year a large fleet of Tournapuls was used for placing fill materials of all kinds. This year a heavy Euclid loader taking a fairly light cut and 12-cu yd bottom-dump Euclid trucks are loading and placing the impervious core. No unusual problems are being encountered in placing the up and downstream shells which are composed of pervious materials. The haul roads of the project are elaborate and extensive to permit ready access to all borrow areas and also to give long dry-out periods to areas furnishing core material. In spite of these problems the volume of compacted fill is steadily growing and it is anticipated that the entire contract of 3,000,000 cu yd will be completed a year ahead of schedule. A

EXCAVATION OF CORE TRENCH and railroad relocation is currently under way for Meridian Dam on Middle Fork Willamette River, unit in Willamette Flood Control Project. Earth and gravel-fill embankment has maximum height of 270 ft above foundation and crest length of 3,106 ft. Side-channel spillway 725 ft long is of free overflow type. Usable storage of 400,000 acre-ft permits operation for both flood control and (later) power generation.





RN RIDGE DAM AND RESERVOIR on Long Tom River provide od control and increased low-water flow. Dam consists of 294 ft concrete section (including spillway) and 10,860 ft of earth emnkment 44 ft high. Placed in operation in 1941, $2,200,000 ructure was first unit of Willamette Valley Project to be completed.



COTTAGE GROVE DAM on Coast Fork, second unit of Willamette Valley Project to be completed, serves twin purposes of flood control and increased low-water flow. Rising to maximum height of 100 ft above foundation, dam consists of 360 ft of concrete section and 1,750 ft of earth embankment.

ther long time for fill placement is rmitted in the specifications priarily because of the difficult condions known to exist in that section of regon for the making of earthfills ith the local soils.

Core Trench Excavated at Meridian

The only work so far undertaken on e earth dam at Meridian is the cavation of the core trench on the ft abutment. This excavation is ing done early to assist in the final sign of the earthfill on this abutent. Test pits and drilling indicate e presence of some undesirable clay the talus slope, and more extensive ploration is believed to be necessary determine whether the clay is in rge lenses or in small scattered ones. the first condition is found the clay ill be removed, but if the second ndition prevails it may be necessary erely to require flatter slopes to proide adequate safety.

Congress has recently authorized e installation of power generating uipment at Detroit Dam, which ill be a 400-ft gravity concrete ructure in a narrow canyon. Power eneration is also authorized at a ecessary reregulating dam a few iles downstream at the Big Cliff ite. Design of the power features for e Detroit Dam will soon be underaken under an engineer design conract. Construction of the dam, hich probably will be placed under ntract next spring, will include a igh-head powerplant, whereas a lowead plant will be incorporated in the ig Cliff Dam.

Bank protection measures are exremely important along the Willaette River as each flood takes a stly toll of fine agricultural land, an retrievable loss because the top soil ows out to sea with the flood waters. he protective works provided vary ith the bend to be protected, hether it is in a navigable section subject to scraping by log rafts being towed downstream or in an area subject to severe attack by the river current at various stages. In general the work consists of grading the bank to a 2 to 1 or flatter slope on which a gravel blanket is placed and over it a protective wearing surface consisting of dumped or hand-placed stone.

Another method is to place cement grout over gravel or stone vibrated to secure deep penetration. In some cases an asphalt treated surface is used. To prevent scouring or unraveling at the toe, an underwater trench is excavated and filled with quarry rock. All types of revetment outlined are frequently used. Interesting and unique placing equipment and construction methods have been developed for each type.

Drift barriers have been found a necessary adjunct to revetments in certain locations to keep down tremendous damage to hop yards, orchards and other highly developed fields from drift carried in by bank flows in some localities where high-water channels have been utilized for agriculture.

Dredging for Navigation

Channel dredging for navigation follows the usual practice of utilizing bucket and pipeline dredges. The only serious problem is that of operating in relatively swift water which required great skill on the part of operators in dredging and in moving equipment, particularly pipelines, into place for dredging operations. Spoil banks from bucket dredges are usually leveled and placed in low-water channels by dozers or carryalls. Pipeline dredges are most effective in making low-water channel closures, which increase the flow in the main channel and thus improve navigation conditions.

Because the Columbia River recently experienced its second largest flood of record, the question arises: What can be done to prevent a recurrence of such a costly disaster? Before answering that question it is necessary to outline briefly the development of the flood.

The Columbia River flood of 1948 was second only to the maximum flood of record which occurred in 1894. The usual seasonal rise in the Columbia system was rapidly accelerated as a result of weather conditions in late May. The winter snowfall was augmented and melting was retarded by a cold spring which continued into May. More than normal precipitation in April and May, in the form of rain and snow, was followed by warm weather and further rain late in May which caused abnormal runoff and flood conditions throughout practically the entire river basin, including the Canadian portion. The Columbia River discharge at Vancouver, Wash., reached about 1,000,000 cfs and continued at approximately that rate for more than two weeks. The first peak reached a stage of 30.2 on the Vancouver gage on June 1. Successive peaks reached approximately this same elevation on June 6 and 14. During the entire interval from May 31 to June 15, the river did not recede below the stage of 29.5 ft.

Long-Range Plan to Be Formulated

The 1948 flood varied in many respects from that of 1894 and for that reason both of these floods will receive major consideration in the formulation of a long-range plan for future flood protection. (Because of the magnitude of the problem only a long-range plan is practicable.) On many tributaries the 1948 flood reached higher crests than the 1894 flood and conversely many tributaries which in 1894 reached their highest recorded stages were not in flood in 1948.

FLOOD WATERS OF COLUMBIA RIVER break through levee carrying Spokane, Portland & Seattle Railway tracks (above, left) to inunda $30,000,000 government housing project at Vanport, Ore. (above, right). Complete destruction of housing development is one of ma disasters suffered in flood of June 1948, which is second only to Columbia's maximum flood of record in 1894. Estimates give 1948 pea flow as 1,010,000 cfs and place damages in excess of $100,000,000.

Examples of tributaries in the first category are the Kootenai River which exceeded 1894 crests by about 1 ft in 1948, and both the Clearwater and Salmon Rivers in central Idaho, which are reported to have crested several feet higher in 1948 than in 1894. On the other side of the ledger is the main Snake River which was relatively low in 1948 whereas in 1894 it was on the rampage. Likewise the Willamette River was not in flood in 1948 although it added materially to the flood flow at Portland in 1894.

The area in which damage occurred in 1948 was extensive and stretched from Canada on the north, Montana and Wyoming on the east, to almost the mouth of the Columbia on the west. Very serious damage occurred in many areas where no protective levees had been provided, yet where much development both agricultural, urban, and industrial had occurred in the many years since the last great flood.

Many Protective Works Ineffective

Many areas which had protective works suffered severe damage and the reasons were many. In the Bonners Ferry area approximately 38,000 acres within 15 private diking districts were inundated when the dikes were overtopped. The crest stage in that area exceeded the crest of 1894 by 1 ft. The flood fight put up there by local people and engineer troops from Ft. Lewis permitted an orderly evacuation and the removal of much personal property from both farm and urban homes.

On the lower Columbia, diked areas were designed for protection against a repetition of floods of various stages experienced in the past such as those of 1933, 1876, or even considerably smaller ones. Low dikes protecting large areas were overtopped early in the flood. Several of the smaller districts with low dikes were able to build them up faster than the river rose and came through with little physical damage.

Other inundations resulted from failures of railroad and highway fills which had been used by the organized districts as a part of their protective works. At several locations such as Deer Island Ore., and Cowlitz No. 1 near Kelso, Wash., railroad fills caused great concern and took prodigious efforts to prevent failures.

Other failures occurred where structures were built through the levees such as tide boxes of ancient vintage in the Marshland District and the concrete pumphouse of Multnomah District No. 1, which included the Portland commercial and military airport as well as several fine golf courses, and much fine truck land.

Damages of all types resulting from the flood have been exceedingly large, probably in excess of $100,000,000. A detailed flood damage survey now being made will provide full information on this subject.

High-Water Profiles Surveyed

High-water profiles have been surveyed on the main stem of the Columbia River and on many of the heavy flood contributors. As stream gaging was carried on actively during the flood, excellent data on discharge rates are available. A reading taken at Rufus, Ore., on the Columbia a short distance above Celilo Falls at the crest of the flood tentatively gives the flow as 1,010,000 cfs.

More than 150,000 acres of diked land, agricultural, industrial, and urban, were saved from inundation by the coordinated and wholehearted efforts of local inhabitants, regular and National Guard troops, regular and reserve Navy and Coast Guard, Maritime Commission employees, and organized groups from the Forest Service, Soil Conservation Servic and Bonneville Power Administration. On an average day during th long peak period nearly 7,000 me were engaged in the flood fight on th lower part of the river. In most area the flood fight was directed by representatives of the Corps of Engineers who had been sent to assis the various diking district supervisors. Contractors contribute greatly to the successful fights wage by making all equipment requeste available for the emergency work.

In the area east of Portland a larg centrally located sandbag filling project was placed in operation in earl June and turned out filled bags at th rate of 10,000 per hour when operating at full capacity. The Portlan District furnished to various dikin districts over 2½ million sand bag for the flood fight and has paid approximately $3,000,000 for labor, materials, plant, and plant rental for it activities during the flood.

The need for an intensive floo fight in many areas where adequat freeboard existed could have bee greatly reduced had adequate annua maintenance been carried on. Evidence of maintenance in some area was entirely lacking both on levee interior drainage, and pumping facilities. Laws similar to those of th State of California are needed in thi region to insure proper maintenanc of local flood control projects. Unless such laws are passed and enforced, those who live behind levee will always have very doubtful security.

Repair of damaged dikes is alread under way and it is expected a breaches will be closed and pumpin plants restored before winter hig waters occur on the lower Columbi River.

The next matter to be considered i what can be done to prevent damag ing floods in future. There are several schools of thought on this subject. Opinions vary, from the view that reforestation and soil conservation practice alone will do the job to the theory that levees alone will suffice—or reservoirs alone. Finally there is the school of thought to which the writer subscribes which advocates a combination of all the methods just mentioned.

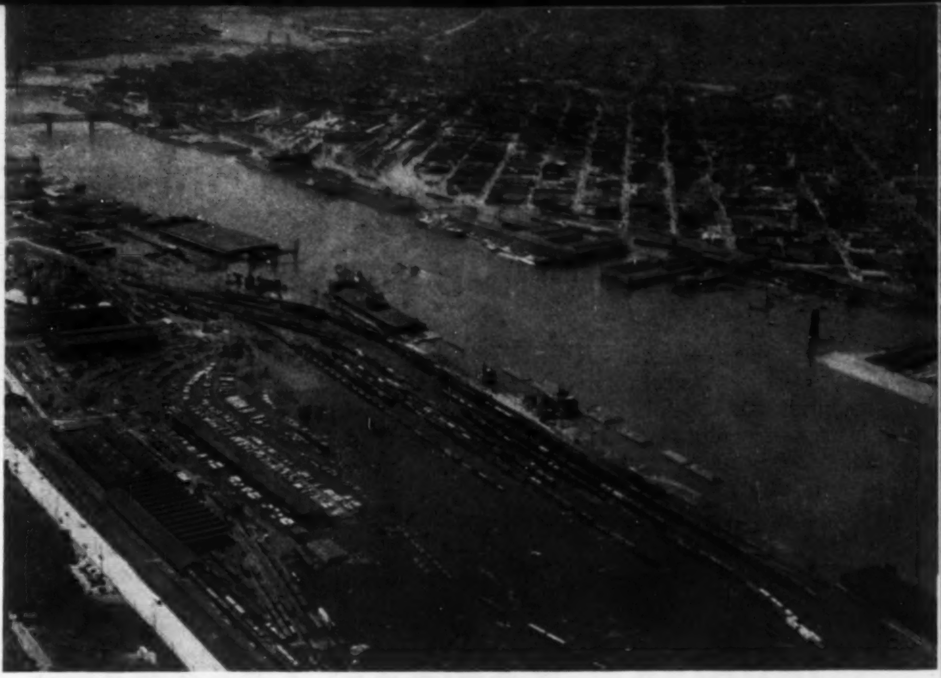
The 1894 flood occurred when this area was almost in its natural state in so far as forest cover and other good land cover are concerned. Therefore, it is evident that such cover alone cannot do an effective job of flood control. There is no doubt that sound reforestation and good soil conservation practice will be helpful and should be included as a part of a comprehensive plan. Erosion losses from all floods are great and we cannot afford them.

As for storage, the volume of major floods is so great that storage alone is impractical as a preventive because of lack of adequate large storage sites and the great cost of providing reservoirs. Similarly, high levees are extremely costly and levees will have to be much higher in future for given flows in critical areas such as Portland-Vancouver, because the large areas of new land to be protected will sharply curtail the present channel capacity.

Some 20,000,000 acre-ft of storage can be provided readily and economically and can be properly distributed and definitely reserved for flood control. With this amount of storage, flows at Vancouver can be held to 800,000 cfs for a flood as large as that of 1894, the largest of record. Levees with safe freeboards for protection against confined flows of this magnitude can be provided, or already exist, throughout the lower Columbia. It therefore appears that levees and storage combined offer a workable solution.

Many Problems to Be Solved

In many areas present and normally foreseeable development readily justifies the cost of levees adequate for protection against confined flows of 800,000 cfs at Vancouver. Also, adequate storage projects are strategically located to control all critical contributing areas. However, many problems must be overcome before the projects for flood control storage can be finally decided on. These problems are international, national, interstate, and local in scope. For instance, storage in Canada would help tremendously, and some projects proposed for locations in the United States would have reservoir areas extending into Canada. Such sites can be used only with Canadian concurrence.



WILLAMETTE RIVER FEELS EFFECT of 1948 flood on Columbia although Willamette is not itself in flood. View above shows inundation of Union Pacific Railroad yards at Albina, Ore., in June 1948 by backwater from Columbia River which extended nearly 30 miles above mouth of Willamette, to falls at Oregon City, Ore.

Public hearings on some projects have developed very strong opposition on the part of federal agencies such as the National Park Service, which objects to the Glacier View Reservoir on the edge of Glacier Park, and the U.S. Fish and Wildlife Service, which objects to projects such as Nez Perce on the lower Snake River and Priest Rapids on the Columbia just above the mouth of the Snake River. The State of Montana has indicated serious objection to the construction of projects in that state which are primarily of benefit to downstream areas in other states because of the tax and other losses imposed by the project on Montana.

Similarly, state fish and game commissions and departments are one with the U.S. Fish and Wildlife Service in their opposition to dams on both the lower Snake and the Columbia. Local opposition comes usually from those people who would be adversely affected by the project such as residents of reservoir areas and some recreationists. However local beneficiaries usually far outnumber those adversely affected and are the ones who proposed the project. All sides of each problem must be given full and careful consideration.

Economic Aspects Favorable

Fortunately, most sites that will provide adequate flood control storage will also permit storage for power or irrigation or both, uses for which there is an urgent need in this region. These multiple benefits make the economic aspects of such projects very favorable.

If only sound engineering and economics were involved, the solution would be simple and all the controversial projects could be recommended such as Nez Perce, Glacier View, Paradise, Libby, and Priest Rapids. These projects, together with the flood control storage which probably will be made available in the Grand Coulee and Hungry Horse projects, would do the job.

The Hells Canyon project will probably have to be substituted for that at Nez Perce, and be supplemented by other projects in the Snake River basin to provide the same amount of control. Likewise, less desirable projects both in effect and cost, location, capacity, and multiple benefits will have to be found to substitute for the other problem projects.

The "308" Review Report on the Columbia River and its tributaries which has been in preparation by the Corps of Engineers has recently been completed. It presents a comprehensive plan for the best over-all use of the waters of the Columbia River basin and includes flood control, navigation, irrigation, power, water supply, fish and wild life conservation, recreation, and other uses. The flood control plan includes many local protection projects involving levees. Recommendations also include the building of some new levees and the raising and strengthening of some existing levees, as well as a reservoir plan which will give a controlled flow of not to exceed 800,000 cfs at Vancouver.

Mapping Proves Economical Expedient in Planning Growth of Large Cities

TOTAL EVENTUAL SAVINGS in dollars and cents inherent in comprehensive surveys of large cities are not computable. Such surveys, however, provide an accurate inventory of existing conditions and form the basis for intelligent planning, permitting a saving which soon equals the cost of the survey. Details of the work accomplished by the Cleveland Regional Geodetic Survey and the Geodetic & Topographic Survey of the City of Pittsburgh are outlined in the first two papers in the following symposium, based on a series of papers presented before the Surveying and Mapping Division at ASCE's Pittsburgh Meeting. That mapping by modern photogrammetric methods can further the work of city planners by furnishing needed map information with important economies in time and tax dollars is emphasized in the third paper.

Cleveland Regional Geodetic Survey Provides Control for 450-Square Mile Area

G. BROOKS EARNEST, M. ASCE

Professor of Civil Engineering, Case Institute of Technology, Cleveland, Ohio; Consulting Director, Cleveland Regional Geodetic Survey

THE CLEVELAND Regional Geodetic Survey is undoubtedly one of the most uniquely operated surveys ever attempted, largely because of the methods used in obtaining and maintaining the organization. The survey is sponsored by state, county, and city organizations which are varied in their political manifestations. Credit for conception of this sponsorship plan is due to Ernest J. Bohn, Director, Regional Association of Cleveland, and also at present Commissioner of City Planning, City of Cleveland. Although changes of administration have occurred during the course of the survey, each succeeding administration has continued to loyally support the project which ultimately will provide Cuyahoga County with accurate horizontal and vertical survey control.

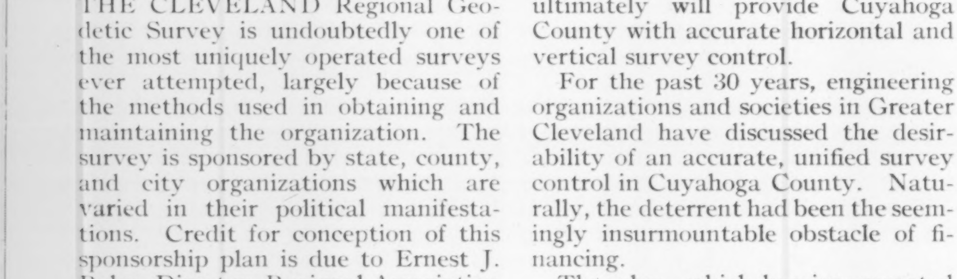
For the past 30 years, engineering organizations and societies in Greater Cleveland have discussed the desirability of an accurate, unified survey control in Cuyahoga County. Naturally, the deterrent had been the seemingly insurmountable obstacle of financing.

The plan, which has incorporated in it the solution to the problem of financing, is simply this: Those public agencies which derive the greatest benefit from the results provide sponsorship in the form of personnel, equipment, supplies and materials, together with essential office space and equipment storage space. The financing therefore is borne jointly by a number of public agencies, thus making the survey possible.

The survey began operations July 12, 1937. Later in the same year the necessary project proposal, to include the WPA as a sponsor, was drafted. The WPA organization provided: (1) Personnel in the lower employment brackets, (2) personnel to perform administrative work, and (3) the bulk of the supplies and materials. WPA withdrew its sponsorship on July 31, 1942.

When completed, the Cleveland Regional Geodetic Survey will provide control for an area of approximately 450 sq miles, about one-sixth of it within the City of Cleveland. The built-up area (Cleveland and its suburbs) includes about 130 sq miles.

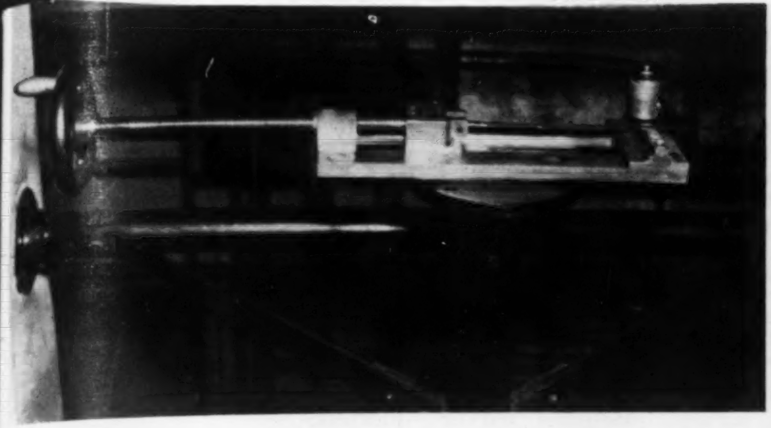
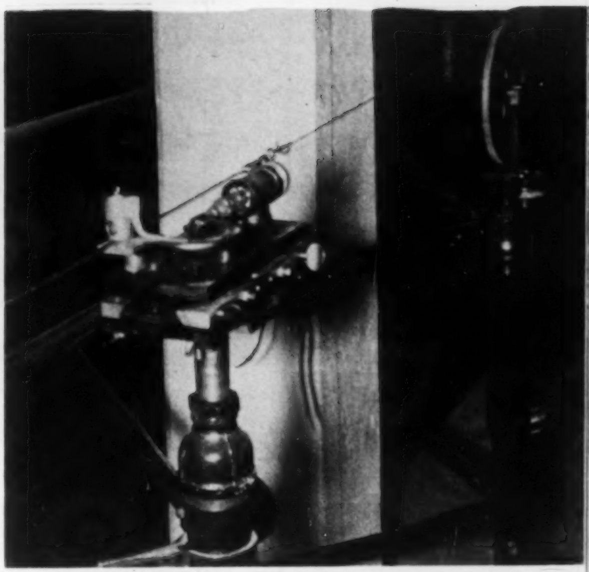
EXISTING STRUCTURES UTILIZED to carry triangulation stations in Cleveland Regional Geodetic Survey include: Silo (below, left) which forms base for platform and tripod following dismantling of silo roof; roof of building (below, center) on which platform is erected with instrument tripod supported on ventilating shaft; and abandoned water tank framework (below, right) which forms support for wooden tower.



Specifications for Survey

The specifications for the several orders of horizontal and vertical control, as well as the plane-table mapping, conform with those recommended in the ASCE Manual No. 10, "Technical Procedure for City Surveys." Slight modifications have been introduced where engineering economy was not affected. Triangulation reconnaissance in the urban area was facilitated by using the roofs of various buildings. Likewise in rural areas, roofs of buildings or barns were used where possible.

The observing specifications conform to the instrument used. For about the first two years, a Kern 1-sec theodolite was on loan from the U.S. Coast and Geodetic Survey. Rec-

NEW EQUIPMENT designed for Cleveland Regional Geodetic Survey includes tape calibrating device developed in Department of Civil Engineering Laboratories of Case Institute of Technology. Shown above is apparatus used to fix zero at one end of calibrating device and, at right, micrometer and wheel at observing end. Micrometer is set in system of precision ball bearings for accuracy in readings.

ommended specifications of the Coast Survey (Special Publication No. 120) were employed when using this instrument. In addition, a 2-sec Kern, a 1-sec Wild, and a 10-sec Gurley have been used in the observing program. With the 2-sec Kern and the 1-sec Wild, 20 positions are required in the direction observing program with a permissible 5-sec spread from the mean prior to rejection and reobservation. Six sets of the standard twelve repetitions for the 10-sec Gurley are required as the equivalent of the theodolite observing programs.

Where the observing program failed to result in triangle closures commensurate with the specifications, reobserving was executed until assured direction values were obtained. There were instances where directions were reobserved seven times and properly meaned to provide the most probable result for each direction. As of January 1, 1948, a total of 927 directions had been observed 2,070 times for an average of 2.24 observations per direction.

There are four Lake Survey triangulation stations in Cuyahoga County. Three are included in the new net; the fourth was recovered and occupied by the U.S. Coast and Geodetic Survey in 1943. One of these Lake Survey stations, "Warrensville," is employed as fix for the projection.

Azimuth and position transfers are made from the triangulation stations to pairs of permanent ground monuments via quadrilateral or center point figures. As of January 1, 1948, a total of 1,477 transfer directions had been observed 2,758 times for an average of 1.87 observations per direction.

The pairs of bronze-capped, precast concrete monuments interspersed throughout the county provide permanent transfer and traverse control stations. These monuments serve the surveying profession with starting coordinates and azimuths. The average distance between the two monuments in each pair is approximately 700 ft. The pairs are spaced approximately 0.6 mile apart in the urban area and 0.8 mile apart in the rural area. To date, 1,520 Cleveland Regional Geodetic Survey Official Monuments have been set, the majority in pairs.

First-Order Levels

The county was divided into 20 large circuits for the initial adjustment of first-order levels. These circuits averaged approximately 17 miles in periphery. They represented a total of 220 miles of levels run in the field. Wherever possible, the level lines and the traverse courses are along the same streets and roads. This arrangement has proved advantageous where the taping party has carelessly dropped a tape length, inasmuch as the stadia interval on the level observations offers an approximate check on the distance between two monuments.

The average loop closure in the initial level least-squares adjustment was 0.025 ft with a maximum of 0.064 ft.

These large level circuits were further subdivided by first-order level lines, usually into four smaller loops. Loops were also added to the periphery of the original net. A total of 93 of these smaller loops went into the final least squares adjustment. The average loop closure was 0.020 ft with a maximum of 0.063 ft.

Second-Order Level Lines

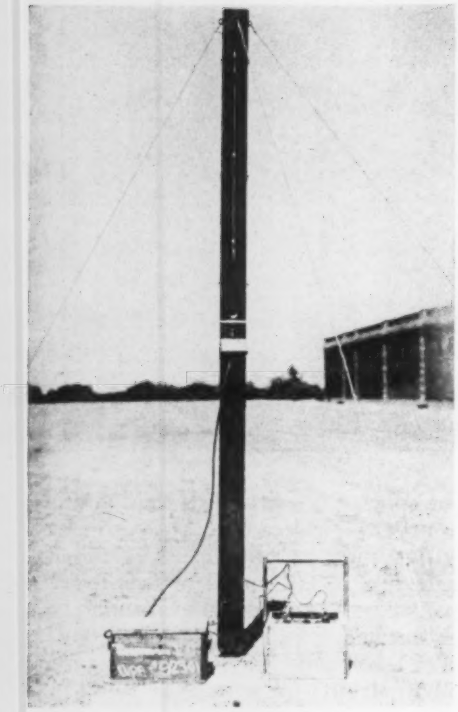
Next, these smaller loops were further subdivided by second-order level lines (levels run in one direction only), usually into four smaller loops. By this means level lines are provided on streets and roads at approximately one-mile intervals, north-south and east-west, throughout the county. The spacing is a little less than a mile in urban areas and a little greater than a mile in rural areas. In all, there are 583.91 miles of first-order levels plus 110.74 miles of reruns (19 percent), and 718.62 miles of second-order levels plus 75.83 miles of reruns (10.5 percent) for a total of 1,489.11 miles of levels to complete the vertical control.

The city and county passed ordinances legislating the adoption of the new mean sea level datum in 1940. In all, there are approximately 3,000 monuments scattered throughout the 450 sq miles. It is not necessary to carry levels further than one-quarter mile on the main streets in urban areas, whereas on main roads in rural areas the maximum run is about one-half mile.

Mapping and Map Projection

An average of four plane-table parties mapped topography from August 1940 to August 1946. These parties worked in strategic areas where major freeway programs existed. The recommended city survey mapping scale—1 in. = 200 ft with a 2-ft contour interval—was used in the work. The mapping is executed in strips which range from 1,000 to 4,000 ft in width.

Since this mapping is for the immediate and specific purpose of location and line design of the freeway and interchange system, considerably more culture is plotted than would be otherwise. All buildings and residences, except garages, are plotted in order to present the requisite criteria for paper location to minimize condemnation proceedings. Accordingly, progress was slowed up and in the six years only 15.66 sq miles were mapped. The plane-table sheets are enlarged to 1 in. = 100 ft by means of an ideograph or precision pantograph, and the location and line design is based directly on the physical data of these enlargements.



RED OR GREEN NEON TUBE mounted on rod facilitates taking of triangulation observations in urban areas where numerous white lights make it difficult for observer to locate ordinary signal lamp target of U.S.C. & G.S. Neon rod, here shown with transformer and 6-v cell battery, can also be used with different transformer for plugging into 110-v a-c. circuit where available.

The above mentioned freeway and interchange system, as an anticipated complete expanded program, is estimated to be a $150,000,000 project. This is just one of many projects which should be on the future planning program for a city the size of Cleveland. Therefore it is a natural presumption that the existing survey control in the Cleveland area, together with the existing plane-table mapping, should save many years of preliminary survey time. Furthermore, the cost of obtaining these survey data has been jointly borne by those public agencies which, in all probability, will be responsibile for the greatest portion of future construction activities.

The plane rectangular coordinate system is used for mapping. The plane is tangent near the center of the county. Since the county has a maximum dimension of 30 miles in the east-west direction and 24 miles in the north-south direction, no noticeable discrepancies should result by the use of this projection at the prescribed scale.

In November 1947, a contract was granted the Aero Service Corp. of Philadelphia to photograph Cuyahoga County from the air and map a portion of it on a scale on 1 in. = 200 ft with a 2-ft contour interval. The resulting maps are to be reproduced by the Brock photogrammetric method.

Equipment Innovations

Several new features in the way of equipment have been developed and used to considerable advantage on the geodetic survey. Mounted red or green neon or fluorescent tubes, 4 ft in length, have decidedly facilitated triangulation observations in the urban area where the myriad of white lights makes it difficult to find, in the theodolite scope, an ordinary signal lamp target of the U.S. Coast and Geodetic Survey type. The necessary transformers permit the use of the ordinary 110-v city current or the 6-v wet-cell automobile battery.

Two new equipment features were developed in the Department of Civil Engineering Laboratories of Case Institute of Technology—the Case taping buck and a device for calibrating tapes. The Case taping buck has a movable strip of stainless steel of tape thickness alongside of which the tape is stretched so that a scratch on the tape is brought to colineation with a scratch on the strip. The strip is then clamped. The strip is attached to a head which is also adjustable for line and rough distance. One leg of the buck is detachable at curve height with an inner pointed shoe which permits leveling the buck at curbs or in rough terrain.

The distinctive feature about the tape calibrating device is the employment of a micrometer in a system of precision ball bearings for obtaining precision readings on the base tape and the tape which is being calibrated.

A number of other unique features were employed in the construction of the traverse tripods, traverse rods, tent frames, signal lamps, and containers for transporting the survey equipment to the field.

Underground Survey of Utilities

In January 1939, the Cleveland Regional Underground Survey was established with the Works Projects Administration contributing the major quantity of manpower. Following the withdrawal of WPA sponsorship, the State Highway Department and the City of Cleveland carried the burden of the sponsorship until March 1, 1944, when all sponsorship ceased.

"Book Sheets," the final product of the Underground Survey, are on a scale of 1 in. = 20 ft and are approximately $2\times 2^1/_2$ ft in size. Over 600 of these cloth tracings have been completed as of February 1, 1944. In addition, 66 strip cloth tracings, each 2×5 ft on a scale of 1 in. = 20 ft, have been completed and used extensively by the Water Department. Over 10,000 utility points (electric, gas, water, telephone, telegraph, and steam) are available for inspection at the Underground Survey Headquarters.

Cooperation with U.S.C. & G.S.

In November 1943, the U.S. Coast and Geodetic Survey began observing on a triangulation chain on the West 81° 30′ meridian south from Cleveland. The Survey tied in to the four old Lake Survey stations and nine stations in the Cleveland net. It used five of its own Bilby towers, ranging from 90 to 110 ft, and at the remaining stations it used the towers constructed by the Cleveland Regional Geodetic Survey. This cooperation on the part of the Coast Survey is greatly appreciated by the sponsors of the Cleveland Survey. The Coast Survey in 1944 expressed its willingness to provide horizontal and vertical control to cities devoid of such, which were planning large-scale postwar construction programs—another commendable gesture.

The WPA expended $464,000 on the Cleveland Regional Geodetic Survey and $421,000 on the Cleveland Underground Survey during its period of sponsorship which concluded July 31, 1942. As of January 1, 1948, the remaining sponsors have expended $795,000 on the geodetic survey and $139,000 on the underground survey. In addition, as of January 1, 1948, the sponsors have been credited for space, truck, instrument, and equipment rental in the amount of $85,000 for the geodetic survey and $24,000 for the underground survey. Recapitulating—a total of $1,148,000 has been expended on the geodetic survey (or an average of approximately $100,000 per year) and a total of $163,000 has been expended on the underground survey (or an average of $32,000 a year for the life of that survey). Obviously, no one sponsor could have afforded to foot the bill for this horizontal and vertical control and the mapping executed to date in Cuyahoga County.

The total cost of the Cleveland survey, however, should not be averaged over the years of its accomplishment, since the control, as established, will benefit Greater Cleveland and Cuyahoga County for many years to come.

Geodetic and Topographic Survey of Pittsburgh Records Physical Facts Needed by Planners

CHARLES B. TAYLOR, JR., Jun. ASCE
Department of City Planning, Pittsburgh, Pa.

SITUATED AT the confluence of the Allegheny, Monongahela and Ohio Rivers, the City of Pittsburgh has an area of 54.3 miles spread over a widely varied terrain of hill and plateau, deep river valleys, and tortuous ravines. The total relief is 660 ft ranging from 710 to 1,370 ft above mean sea level. Engineers, architects and community planners faced with many vexing and complex problems due to the extreme irregularity of the terrain, have been aided tremendously in solving these problems by the Geodetic and Topographic Survey of Pittsburgh.

Since Pittsburgh was quite young, numerous surveys of small areas for specific purposes have been made each year. These surveys were adequate for their immediate purposes but were so unrelated in datum and accuracy that their data could not be assembled even to make a reliable map of the city. Therefore, in 1923, the Geodetic and Topographic Survey of the City of Pittsburgh was started.

The objects of the survey are to furnish: (1) A series of topographic maps of the city and some surrounding territory; (2) a control survey consisting of a system of marked survey points of known elevation and horizontal position; (3) a complete property map showing boundaries of public and private properties; and (4) a map of surface and subsurface utilities of the city and its surrounding area. Perhaps the most notable characteristics of this survey, aside from its accuracy, are its inclusiveness and permanence. It is designed to furnish a complete and highly accurate inventory of the physical facts relating to the ground surface. Because of its form and character, the survey is capable of being expanded indefinitely as conditions may require.

This survey has been prosecuted aggressively from the time of its inception to date except for a period of six months in 1932 and other intermittent intervals aggregating about five years when lack of sufficient appropriations and, during the war, lack of available personnel, compelled suspension of field work. The number of persons employed by the city has varied from 3 to 34. During the period of federal relief, as many as 150 workers were employed. Despite the difficulties inherent in the rapid expansion of personnel, the high technical standard of the survey was maintained and the rate of progress in mapping was greatly increased. In addition considerable progress was made in recovering and referencing monuments indicating municipal and private property boundaries.

Detailed specifications of the survey are contained in Manual No. 10, "Technical Procedure for City Surveys," published by the ASCE in 1934. The men originally responsible for the survey made important contributions to the preparation of Manual No. 10 and their experience was of obvious assistance to them in making these contributions. The schedule, progress and general specifications follow:

1. First-order triangulation, the framework or foundation of the horizontal control, has one station per square mile in developed areas and about one station every 2 sq miles in undeveloped areas.
2. Precise levels, the foundation of the vertical control, have monuments strategically placed in accordance with the need and the terrain.
3. Precise traverse supplements and makes available the results of the triangulation and level networks.
4. The topographic map, published at a scale of 1 in. = 200 ft, shows $2^1/_2$- and 5-ft contours.
5. The property map, at a scale of 1 in. = 50 ft, is the base map for all departmental information where figures and dimensions are required.
6. Wall maps, both planimetric and topographic, are at scales of 400, 800, and 1,600 ft to the inch.

Triangulation Network

The triangulation network covers an area of 221 sq miles and is composed of 12 measured bases, 3 azimuth observations and 137 first-order and

CHIMNEY OF SCHOOL BUILDING provides strategic location for triangulation station in network covering 221 sq miles in Pittsburgh area. First-order network forms foundation for three types of maps: Topographic map to scale of 1 in. = 200 ft; property map to scale of 1 in. = 50 ft; and wall maps, both planimetric and topographic, to scales of 400, 800, and 1,600 ft to the inch.

48 secondary stations. This network was adjusted in sections by the method of least squares having 19 main and 20 secondary adjustments. The zero of the plane rectangular projection is 100,000 ft south and west of the reference meridian North 40 26 00 and West longitude 80 00 00, as located from triangulation established by the U.S. Geological Survey in 1900.

In adjusting the network by the sectional method, where each adjustment covers the territory between bases, some difficulty was encountered. After the adjustment of the first section, meeting the fixed conditions on the perimeter proved to be somewhat of a problem which increased when subsequent sections were adjusted, indicating large corrections to the directions adjacent to these fixed conditions.

To adjust simultaneously such a large compact triangulation network as that of the City of Pittsburgh would be impractical, as the great number of unknowns and equations would make the adjustment bulky and unwieldy. The problem can be solved, however, by dividing the triangulation net into two parts, the skeleton and the supplemental networks. The skeleton network should cover the entire area with the stations strategically placed so as to form strong figures and permit the measurement of angles to the supplemental stations, and with a sufficient number of measured bases to insure good checks throughout the area. The main scheme can be completed within a minimum of time and adjusted simultaneously. The supplemental network will be a breakdown of the main scheme and will consist of a number of small nets each within an area bounded by several main stations. This breakdown, which can be made where and when the need demands, will eliminate the accumulation of small discrepancies.

The precise level net covers an area of approximately 60 sq miles and totals 550 lin miles, of which 436 lin miles were run by the Department of Public Works in 1912 and the remainder by the Pittsburgh Survey.

Precise Traverse Net

The traverse net covers an area of approximately 100 sq miles and totals 1,186 lin miles. The first traverse adjusted was by the junction-point method which was succeeded by a least square adjustment described as "An Improved Method for Adjusting Levels and Traverse," published in the Proceedings of ASCE, October 1939.

Experiments conducted to improve the accuracy of the traverse proved that lines running between triangulation stations indicated excellent closures in the direction of the line and excessive closures at right angles to the direction of the line. Remeasurements showed wide variations in the angular measurements and excellent comparisons in the distance measurements which were indicated by the closures, since a discrepancy in an angular measurement would increase the closure at right angles to the line, while a discrepancy in a distance measurement would remain the same. A study of the spacing of the stations showed considerable irregularity, with some stations only 150 to 200 ft apart. This close spacing naturally increased the number of the stations and the opportunities for angular discrepancies.

An experimental net was run in a section bounded by several triangulation stations, with a view to the spacing of the stations rather than the need for control. The probable error of this net was one part in 56,000 which proved that the triangulation net like the traverse net should be in two sections, skeleton and supplemental. The supplemental net can be limited to two or more skeleton stations and a further adjustment made. In either case discrepancies in angular measurements can be confined to a short distance instead of increasing to large proportions.

The traverse is constantly being used by engineers and surveyors who have found the standard bearings, coordinates and elevations furnished for the points to be very helpful. A practice of the survey is to tie to and coordinate the center-line stakes of new construction. If an express highway has a divider strip, the survey places monuments along the center line after construction has been completed.

Area Mapped to Date

The area mapped to date covers 86 sq miles or 146 sections or sheets. Each sheet covers an area of 0.59 sq mile and is 1 min of longitude in length and 35 sec of latitude in width. Starting at the origin of the coordinate system, North latitude 40 26 00 and West longitude 80 00 00, and making this point the common corner for four sheets, the layout was extended to cover the entire area.

The field sheet is of the best grade of heavy white drawing paper mounted on aluminum. The scale to which the maps are sketched in the field is 1 in. = 165 ft. This scale was selected to assist the topographer in sketching the detail to be shown on the map, and was determined by the size of the equipment.

Upon completion of the field work, the next step is the office searching and plotting of property and boundary lines. When the survey had the use of relief work personnel, several field corps were assigned to locate and coordinate any type of property witnesses. These points plotted on the field sheets furnished the property man with an accurate picture of all the surrounding territory, which enabled him to determine the location of boundaries, and where inaccuracies existed, to make a compromise. The use of such witness points has proved an invaluable aid to surveyors, who have made it a practice to consult the Geodetic and Topographic Survey before going into the field to make a survey. After completion, each sheet is reproduced in four colors at a scale of 1 in. = 200 ft.

Property Map

The property map has not yet been started but it will be on a scale of 1 in. = 50 ft, and will show the coordinates of all street corners, angle points, points of curve, and the actual and recorded distances. Since, as previously mentioned, all witnesses to property corners have been tied to the traverse whenever possible, the property map can be started as soon as the traverse has been adjusted.

Some idea of the usefulness of the survey to the public is indicated by the fact that there were 927 requests for survey information during 1947. In addition survey data were used by the Department of City Planning, and survey information, such as the topographic sheets, was in the hands of other agencies.

Emphasis should be placed on the value of the horizontal and vertical control, which is equally as important from an economic standpoint as the topographic map. A municipality that is contemplating the making of an aerial map would find it profitable to increase its appropriation so as to provide a control network of sufficient size and accuracy for all purposes. The writer also recommends that municipalities establish a separate bureau to supervise the base survey, extend it, and correct their inventory as changes are made on the ground. Like private business, which finds it profitable to keep a record of material on hand, so cities will find it advantageous to secure up-to-the-minute information about themselves, at the same time increasing their service to the public.

Photogrammetric Methods Cut Time And Costs of City Surveys

VIRGIL KAUFFMAN

President, Aero Service Corp., Philadelphia, Pa.

LIKE TOPSY, most American cities just "growed." There was no zoning, not much planning, and very little thought for the future. Many cities' map information is in the same state. It, too, just grew or accumulated. Very little of it is current, solid map data. The lack of good map information is not the fault of the city engineers or planning commissions. They want it. But the costs of obtaining accurate map information by ground methods are high, and the budgets low. Moreover, ground surveys are necessarily slow.

In the past few years there has been a growing public consciousness of the need for city planning. Many communities are moving toward active mapping programs today. Happily, within the last few years photogrammetric mapping has come of age and can deliver maps of specified accuracy at lower costs and do it faster.

Needs of City Agencies

Various city agencies require maps but the two agencies which have the greatest need for them are the City Planning Commission and the City Engineer's Office. The City Planning Commission uses maps for about ten main purposes:

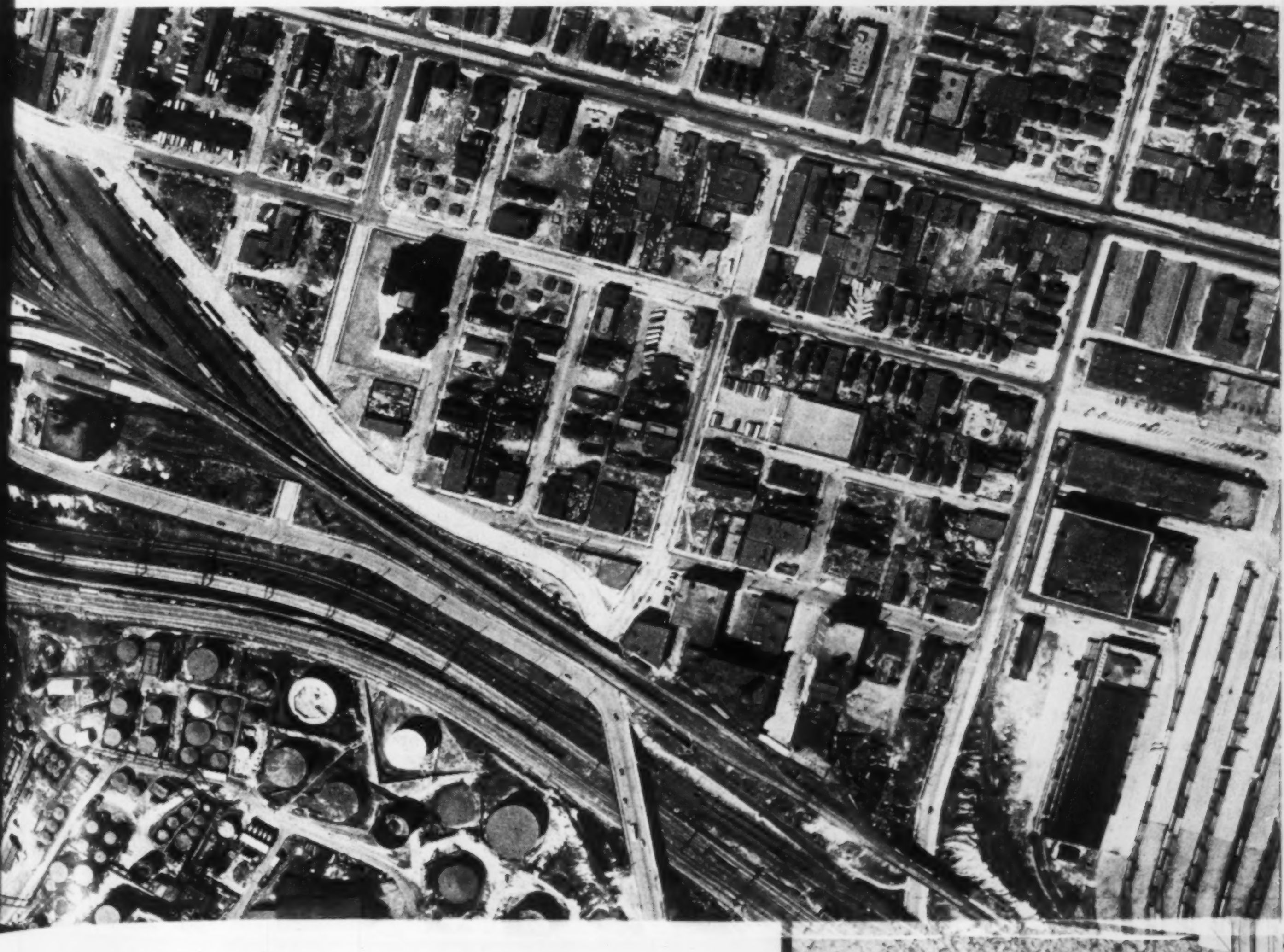
1. New subdivision layouts
2. Replotting of old and new streets
3. Locating recreation sites
4. Redevelopment studies
5. Selecting sites for hospitals, laboratories, public buildings
6. Industrial land use and material storage
7. Traffic flow studies
8. Transportation studies
9. Accident studies
10. Conferences, publicity, and reports

The City Engineer's Office needs maps to implement some of this planning, and also uses maps to fill location and design requirements for four types of structures:

1. Highways and streets
2. Sewerage and disposal plants
3. Flood control structures
4. Drainage structures

In broad terms, the foregoing are the mapping requirements of cities. Can maps be produced from an aerial

TYPICAL AERIAL PHOTOGRAPH made for Cleveland Regional Geodetic Survey shows wide variety of ground detail. Pictures taken from altitude of about 3,000 ft, with Brock Precision Aerial Camera, form basis for topographic map at horizontal scale of 1 in. = 200 ft, with 2-ft contour interval.



PRECISION INSTRUMENTS CONTRIBUTE to accuracy of aerial mapping both in office and in field. In office (above, left) aerial photographs are viewed as stereo pairs through precision equipment and contours are drawn on plastic template which is placed over stereoscopic image. In field (above, right), surveymen employ modern precision theodolites to establish network of ground control. Use of compact radio transmitter-receiver sets permits coordination between survey crews.

photographic base to meet these needs? Yes, and economically.

Here's how mapping by photogrammetry is done. First, a flight plan is carefully laid out. The survey area must be covered completely with a minimum number of photographs. Furthermore, good planning takes into consideration the location of available horizontal and vertical control as it exists in the field, as well as contemplated control. Well directed field survey work, establishing an adequate network of ground check-points, is an essential in aerial mapping. If tied into a good network of primary controls, the surveying for photogrammetric controls in general follows the pattern of standard surveying work.

Some cities prefer that the surveying for aerial work be performed by their own engineering staff, with one or two aerial mapping men to coordinate and supervise some phases of the work. Other cities may expect the field survey men of the contracting company to do the entire job.

The experienced photogrammetrist works to rigid specifications. He plans for aerial photographs with a 55- to 60-percent overlap in the line of flight, and an average side overlap of 20 percent. Such overlap is necessary for optical reasons. Similarly, the photogrammetrist requires that the photos have not more than 2 deg of tilt and that the photos for the flight line average not more than 1 deg of tilt.

Supplementing the aerial photography is the field survey work already mentioned, which provides approximately three points with elevations per photograph, and one point with horizontal position every four photographs. Stereoscopic interpretation is aided by these data, and in a series of highly precise operations accurate topographic maps are developed. A single photograph often covers an area as large as 64 to 250 acres, and the photogrammetrist translates all the pertinent data from such pictures, precisely and rapidly.

Some cities require a contour interval of 5 ft; others require 2-ft intervals. Our standard map specification provides that at least 90 percent of all contours shall be plotted within one-half of a contour interval of correct position, and that no contour shall be more than one interval from its correct position. On a 2-ft contour map then, we work within a 1-ft tolerance most of the time. Our horizontal scale tolerances are also exacting. Ninety percent of all well-defined planimetric features are plotted within $^1/_{50}$ of an inch of true position, and no such point varies from position by more than $^1/_{25}$ of an inch. We usually work at scales of 1 in. = 200 ft or 1 in. = 100 ft.

Cost and Time Required

How fast can such maps be completed and how much do they cost? The Cleveland Regional Geodetic Survey's Report No. 4, issued in June 1946, answers these questions. Noting that ground mapping has been a "slow and costly operation," it points out that four years were required to complete 12 sq miles of mapping. It adds that at this rate, it would take 150 years to map Cuyahoga County. Since the cost for the area mapped was approximately $6,000 per sq mile, the costs for mapping Cuyahoga County on this same basis were estimated to be:

Field mapping: $6,000 per sq mile × 450 sq miles	$2,700,000
Inking of sheets: $500 per sq mile × 450 sq miles	225,000
1,000 four-color copies: $600 per sheet × 690 sheets	414,000
	$3,339,000

Comparing these estimates with the cost of photogrammetric methods, the report states: "The estimate included the provision of 1,000 four-color copies of each of 690 sheets necessary to cover the county, for a total cost of $1,440,000. In the matter of time, the first four sheets would be available 45 days following date of flying for photography, and delivery would be made on the basis of four per week thereafter. At this rate it would take slightly better than three years to map Cuyahoga County. This time could be cut in half by double shifts, if necessary." Thus the cost by the photogrammetric method in this case is only 43 percent of the cost by the ground method and the time schedule is 50 times faster.

A few years ago, the Aero Service Corp. performed an aerial survey of a main highway link for the Inter State Park Commission of New York. It was 31 miles in length. The Park Commission's estimate was $74,400 and two years' time for the transit and line method. Our schedule was 90 days, and the cost $17,600.

USEFUL FOR PLANNING WORK in Philadelphia and environs is 7 × 8-ft aerial mosiac covering area of about 500 sq miles. Scale is 1 in. = 1,320 ft. Hundreds of aerial photographs, assembled in accordance with rigid network of ground control, make up wall map here being consulted by Paul F. Croley, Senior Project Analyst, and Talbot Jones, Assistant Land Planner, of Philadelphia City Planning Commission.

Obviously costs vary with the individual survey. The survey area, its location with regard to airport facilities, the contour interval, and other factors must be considered. But two facts stand out: (1) Photogrammetric methods take a lot less time; (2) they bring a substantial saving.

Value of Photogrammetric Data

What is the value of the data provided by photogrammetric surveys? An answer to this question is included in the Cleveland Regional Geodetic Survey Report, as follows:

"1. All Cuyahoga County will be based on one system relative to distances and bearings. Future individual surveys of any small sections will be sure to fit together.

"2. All Cuyahoga County will be based on one system relative to elevations (mean sea level).

"3. Positive checks will be provided at many more frequent intervals than heretofore.

"4. Tax assessment maps may be brought up to date with assurance that all areas are properly considered.

"5. The true boundaries of the county may be determined, from which the exact area of the county may be computed.

"6. The true boundaries of all political subdivisions may be correctly determined.

"7. Planning for all future construction will be greatly facilitated.

"8. Actual construction will be greatly facilitated.

"9. General planning in and for city and metropolitan parks will be greatly facilitated.

"10. Future surveys will be expedited in field and office scope.

"11. The topographic maps, which are being made to a scale of 1 in. = 200 ft with contours representing 2-ft difference in elevation, will save thousands of man-hours of preliminary survey time.

"12. The topographic maps will provide a medium for all types of planning for the entire county, whether it be a route for an express highway, drainage for a sewer system, housing, or rehabilitation.

"13. In practically all instances the topographic maps will provide sufficient data for a preliminary financial estimate of a construction project.

"14. The topographic maps will be of inestimable value to state, county, city, and village officers in the conception, planning, and actual expansion of functional facilities.

"15. The topographic maps will be of inestimable value to all public offices in their maintenance programs."

Other products, in addition to the topographic maps, are available from these same aerial photographs. From the negatives it is possible to supply photo maps, photo relief models, and single enlargements at almost any scale. Most popular is the photo map, commonly called a mosaic or photo mosaic. While not as accurate in position as the topographic map, it has good horizontal position in areas of low relief. For over-all planning work, it is extremely useful; per unit of cost it is probably the best map that can be made.

There have been parallel refinements in the photo mosaic production. Each photograph is carefully calibrated for air tilt and scale; any variations are exactly rectified in precision laboratory cameras which produce corrected copies. These corrected or rectified photographs are then assembled over a network of horizontal control into an accurate composite. The horizontal control is obtained by graphical triangulation, using the photographs as a base.

The photo relief model or phototopo map is making its first public bow this year. The aerial photograph is supported on a lightweight plastic base, which is so shaped and formed as to show graphically the relief for the area. This type of map has great potential value in planning work and planning displays.

By way of summary, the following list of typical map needs and photogrammetry's answer to them has been prepared:

Maps for New Subdivision Layouts. The photographic map or mosaic, with its wealth of cultural detail, ideally meets the needs of the planning staff. Topographic maps would better satisfy the engineering department.

Recreation Site Locations. The composite mosaic, showing the entire city on a single sheet, affords the over-all view needed for selecting recreation sites. After the site is selected, the topographic map is needed for proper design and development.

Conferences, Publicity, and Reports. Photo maps or photo relief models tell a clear, quickly understandable and dramatic story to the public who must support all planning and engineering programs.

(*Continued on page 88*)

THREE-DIMENSIONAL MODEL—called photo-topo relief map—is recent development which helps engineers make topography and planning problems understandable to laymen. Model is made by bonding contoured aerial photographs to flat plastic sheet, which under heat and pressure is formed in mold to show topographic character of area. Aerial photos provide planimetric detail as well.

Builders of Penn-Lincoln Parkway East Solve Complex Design and Construction Problems

New Parkway Serves Pittsburgh's Congested Triangle Area

START OF CONSTRUCTION on the Penn-Lincoln Parkway East in July 1947 climaxed at least 20 years of preliminary planning and more than four years of detailed engineering studies. This parkway is the first of several projected to serve Pittsburgh's Golden Triangle, which covers an area of less than a half square mile on which highways converge from all points of the compass. The presence of two rivers, rugged terrain, main railroad lines and terminals, and existing highways and streets, all add to the difficulties of design and construction. The four articles which follow, originally presented before the Structural Division at the ASCE Pittsburgh Meeting, cover diverse aspects of the Penn-Lincoln Parkway East. Mr. Schmidt discusses the 9½-mile project as a whole; Mr. Richardson explains the arrangement of the Downtown Interchange; Mr. Singstad describes the design and construction of the 4,225-ft Squirrel Hill Tunnel; and Mr. Fuller treats the parkway crossing under the Pennsylvania Railroad in the Borough of Edgewood.

Comprehensive Traffic Studies Determine Choice of Parkway Route

E. L. SCHMIDT

Chief Engineer, Pennsylvania Department of Highways, Harrisburg, Pa.

NEED FOR EXPRESS or controlled-access highways through urban areas has long been recognized but the problem was too large for any one political subdivision to accomplish without financial aid. Such help was made possible by enactment of the Federal Aid Highway Act of 1944 which specifically set aside certain sums for the planning, design and construction of urban highways, with the provision that the states should match dollar for dollar the amounts made available by the federal government.

At the time of the enactment of this law, Pennsylvania was unable to participate in so far as express or controlled-access highways were concerned. Special state legislation permitting the design and construction of such highways was however soon secured and became effective on May 29, 1945.

The need for an express highway through Pittsburgh from east to west had previously been evident and planning work began in December 1943. The problem was to provide a controlled-access highway between the downtown triangle and points east, for traffic to and from the William Penn Highway U.S. 22, Lincoln Highway U.S. 30, and the area comprising the eastern part of the City of Pittsburgh and Allegheny County with a destination in Pittsburgh's downtown triangle or points south, west and north of that triangle. In this paper, only the section of parkway east of the downtown triangle will be considered.

Six principal arteries converge on the downtown triangle from the east: (1) Second Avenue, (2) Boulevard of the Allies, (3) Forbes Street, (4) Fifth Avenue, (5) Bigelow and Baum Boulevards, and (6) Liberty Avenue, Penn Avenue and Butler Street.

All the above arteries accommodate surface street railway cars with the exception of the Boulevard of the Allies and the Bigelow-Baum Boulevard. Parking is prevalent on both sides of these arteries with the exception of the Boulevard of the Allies and Bigelow Boulevard from Seventh Avenue to the Bloomfield Bridge. The inadequacy of all six of the routes listed is complicated by intersecting streets with numerous traffic signals to control heavy cross traffic, both vehicular and pedestrian, as well as by other intersecting streets without traffic-light control. Left-hand turning movements as well as loading and unloading of vehicles at abutting property, further delay the free flow of traffic.

In making a thorough study of the traffic problem, data were compiled from five sources:

1. County-wide origin and destination survey made in 1937 by the Pittsburgh Department of City Planning.
2. Pittsburgh Bureau of Traffic Planning data.
3. Allegheny County Traffic Division data.
4. Pennsylvania Department of Highways Plan Division data.
5. A study of turning movements in the downtown area made in September 1945 from a supplemental origin and destination survey by the Highway Department.

The study showed that eastbound and westbound traffic were approximately equal in a 24-hour period. The 33-percent increase in traffic shown to have occurred between 1931 and 1941 led to the assumption that ten years after the 1941 volumes are again reached the traffic volume will increase an additional 33 percent.

Possible Routes Studied

Because of the topography, only one location was available between the eastern terminus on U.S. 22 and a point in the vicinity of Braddock and Swissvale Avenues in the Borough of Edgewood. From this point to the downtown triangle, however, there were three possible locations:

1. Penn Avenue location, which traverses the northern section of Frick Park, and the suburbs of Homewood, Point Breeze, Shadyside, Bloomfield, and parallels the Pennsylvania Railroad, Penn Avenue and Liberty Avenue to the triangle, not

far from Duquesne Way. The total length of this section from the eastern terminus is 9.89 miles.

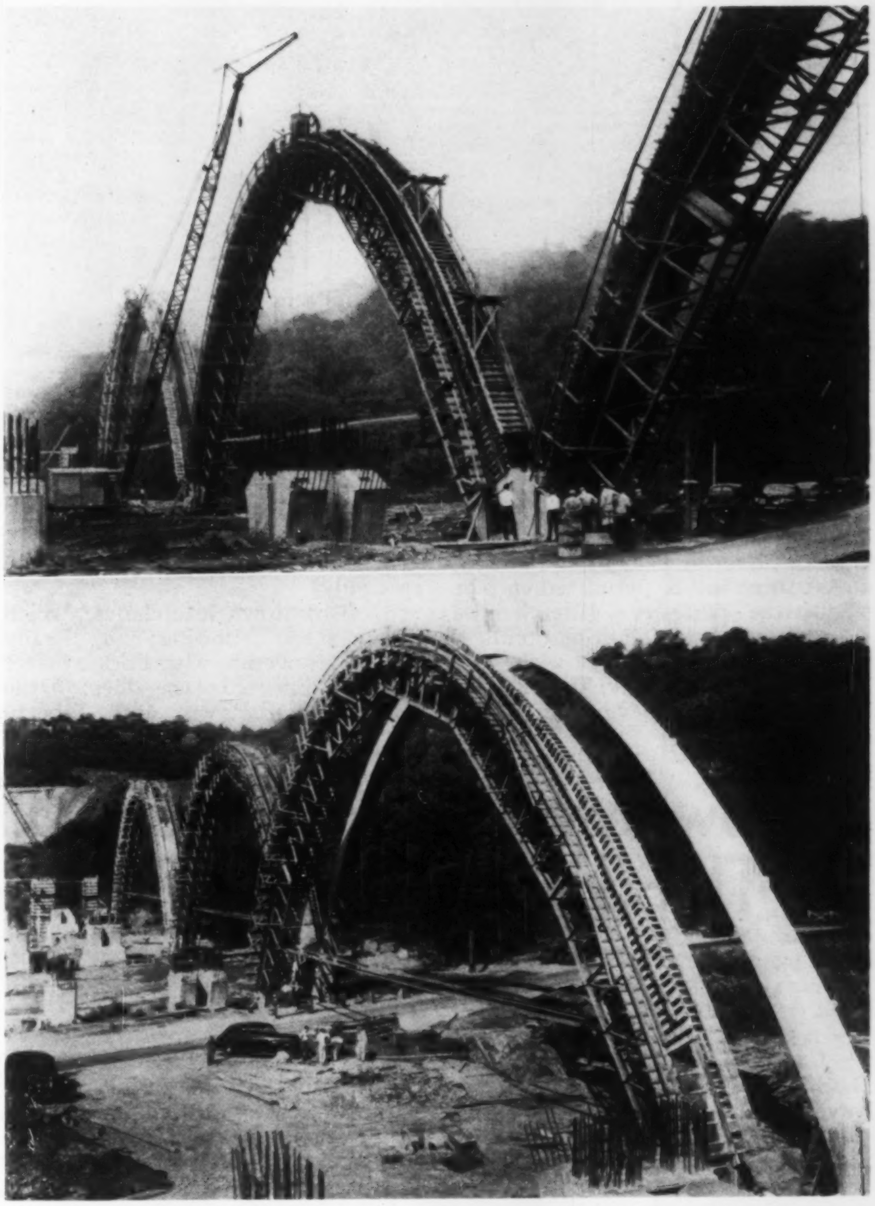
2. Fifth Avenue location, which traverses the central portion of Frick and Schenley Parks under Squirrel Hill, through Oakland, and parallels Fifth Avenue to the downtown triangle, where it would intersect the proposed Crosstown Boulevard approximately midway between the Penn Avenue location and the Second Avenue location. The total length of this section from the eastern terminus is 8.53 miles.

3. Second Avenue location, which traverses the southerly edge of Frick and Schenley Parks, under Squirrel Hill, through Greenfield to the north bank of the Monongahela River, thence paralleling the Monongahela River and Second Avenue to the downtown triangle. The total length of this section from the eastern terminus is 9.11 miles.

Selection of Route

In comparing the advantages of these three possible routes, the following factors were studied:

1. Effect of necessary viaduct construction in residential areas which would not be entirely compensated for in the settlement of property damages.
2. Location of the approach to the downtown triangle in respect to the distribution of traffic with a destination south, north and west of the downtown triangle.
3. Recognition of the construction and operation costs of tunnels.
4. Location in undeveloped areas, providing greater freedom in designing the project.
5. Location which will not necessitate discharge of through traffic into the city streets in the downtown triangle.
6. Amount of improved property condemned and removed permanently from the tax column.



COMMERCIAL AVENUE BRIDGE, $1,800,000 three-arch concrete structure 980 ft long, carries four-lane Penn-Lincoln Parkway across Nine-Mile Run to eastern portal of Squirrel Hill Tunnel. In view above, Blaw-Knox steel centering weighing 30 tons per arch rib is in place ready for concrete. Ribs measure 170 ft between springing lines. Pour by means of crane and bottom-dump bucket is in progress at top of center rib. Transit-mix concrete is used on job by Dinardo, Inc., contractors. In view below, form centering is removed from completed rib and repositioned for pouring second rib of first arch. Movement was completed in several hours, ends being moved alternately a few inches each time. Clearing for Squirrel Hill Tunnel portal appears at extreme left.

Design Standards

The Second Avenue location was adopted and designated as the Penn-Lincoln Parkway East. The design for this parkway, based on the anticipated traffic, is a four-lane divided highway from the eastern terminus to the Forward Avenue interchange located at the west portal of the Squirrel Hill Tunnel, and a six-lane divided highway from the Forward Avenue interchange to the lower end of the downtown interchange at Water Street. Lane widths will be 12 ft throughout the parkway proper with shoulder widths of 8 ft in cuts and 10 ft in fills. The pavement is to be of 10-in. reinforced concrete with a raised median strip, 4 ft in width, having reflectorized battered curbs. The project is designed for a safe speed of 60 miles per hour.

A special subgrade of 6-in. depth will prevail. Construction will be the open type, with stabilized shoulders where disabled vehicles can park, thus permitting the free use of the traffic lanes at all times. The full shoulder width is extended over all bridges on the parkway proper to give drivers the same freedom of movement at these points as is afforded on the rest of the project. Bridge structures are all of the deck type which adds another safety feature to the design.

The Squirrel Hill Tunnel, which consists of twin tubes approximately 4,200 ft in length, is discussed in detail in the article by Ole Singstad, M. ASCE, tunnel consultant.

Interchanges for on and off traffic will be provided where the amount of

ROCK EXCAVATION is under way at east portal of tunnel to carry Penn-Lincoln Parkway under Squirrel Hill. Steel arch ribs provide temporary support for tunnel roof where rock is not self-sustaining. Tunnel section will be connected with ventilation building at each end of tunnel by short cut-and-cover sections. See Figs. 1 and 2.

traffic justifies and costs are not prohibitive. All interchanges will provide for direct movement of vehicles; no left turns will be permitted onto or off of the parkway. Interchanges are situated at the following points:

1. Eastern terminus with the William Penn Highway, U.S. 22
2. Ardmore Boulevard, U.S. 30
3. Braddock Avenue
4. Forward Avenue
5. Bates Street (to and from the east only)
6. Downtown Interchange, which involves the following: (*a*) Brady Street, connecting with Forbes Street and the Boulevard of the Allies; (*b*) the proposed crosstown and Liberty Bridge via the Boulevard of the Allies from the Brady Street interchange; (*c*) Grant Street; (*d*) Smithfield Street; (*e*) depressed highway and surface elevation at Water Street; (*f*) Wood Street.

The downtown interchange has proved to be a very difficult one and is discussed in detail in the article by George S. Richardson, M. ASCE, bridge consultant for the parkway.

About 2.79 miles west of the eastern end of the parkway, and about 1.49 miles east of the Squirrel Hill Tunnel, the topography requires that the parkway cross Edgewood Avenue, Laurel Street, and the main line of the Pennsylvania Railroad almost at right angles. It was decided to run the parkway under these facilities because the parkway lies in a valley through the Borough of Edgewood, which in fact makes it a natural depressed highway. A detailed description of the design and construction of the underpass structures is given in the article by S. L. Fuller, M. ASCE, in this symposium.

Downtown Interchange Will Carry Traffic Through Congested Pittsburgh Triangle

GEORGE S. RICHARDSON, M. ASCE

Consulting Engineer, Pittsburgh, Pa.

DESIGN OF the Penn-Lincoln Parkway East involved major difficulties throughout almost its entire length, but the chief problem was the development of a satisfactory plan for the western terminus providing for distribution of traffic in and through Pittsburgh's downtown "Triangle." Pittsburghers think of the Triangle as bounded by Grant Street and the Monongahela and Allegheny Rivers (Fig. 1). The nerve center of the whole Pittsburgh metropolitan district is concentrated within this small area of less than a half square mile. The final Downtown Interchange plan includes connections to Ferry Street about 2,000 ft west of Grant Street, and other distributing connections some 8,500 ft east of Grant Street, so that the complete interchange is spread over a total length of two miles. This terminal is the most important element of the Penn-Lincoln Parkway East. It is the key to the successful collection and distribution of traffic in the most congested area of the whole project.

It is necessary to consider present highway and street improvements, commercial development, railroad facilities, and terrain to understand the difficulties of developing a plan for the interchange. At the present time, Penn and Lincoln Highway traffic from the east is routed into and through the Triangle along the Boulevard of the Allies. This boulevard serves also as one of only two principal routes for local traffic having origins and destinations in Pittsburgh east of the Triangle and for a large suburban area. The other route which serves somewhat the same area is Bigelow Boulevard, which enters the Triangle at the upper end of Grant Street. The Boulevard of the Allies is located on a high bluff roughly paralleling the Monongahela River, and comes to grade in the Triangle near the lower end of Grant Street. The first section was built immediately after World War I, and the roadway is very narrow as operated with four lanes of traffic.

The Water Street improvement along the Monongahela waterfront was built as part of a circumferential bypass around the perimeter of the Triangle. From Grant Street west to Short Street it consists of a depressed roadway for through east-west traffic which underpasses intersecting north-south streets. Roadways at surface level on each side provide for local traffic.

Grant Street is the most important north-south street in the Triangle. About 1,100 ft upstream from it is the Liberty Bridge, a high-level structure providing a direct connection between the Liberty Tunnels and the Boulevard of the Allies. The main approach from the bridge into the Triangle underpasses the boulevard and connects to the street system at Forbes Street and Sixth Avenue. As presently operated all inbound traffic into the Triangle must use this Forbes Street approach. Outbound traffic has a choice of routes either via this approach or via the Boulevard of the Allies from Grant Street to the bridge.

The Smithfield Street Bridge, one block below Grant Street, is an important route for streetcar traffic but is of minor importance for vehicular traffic. The South Tenth Street Bridge provides another crossing of

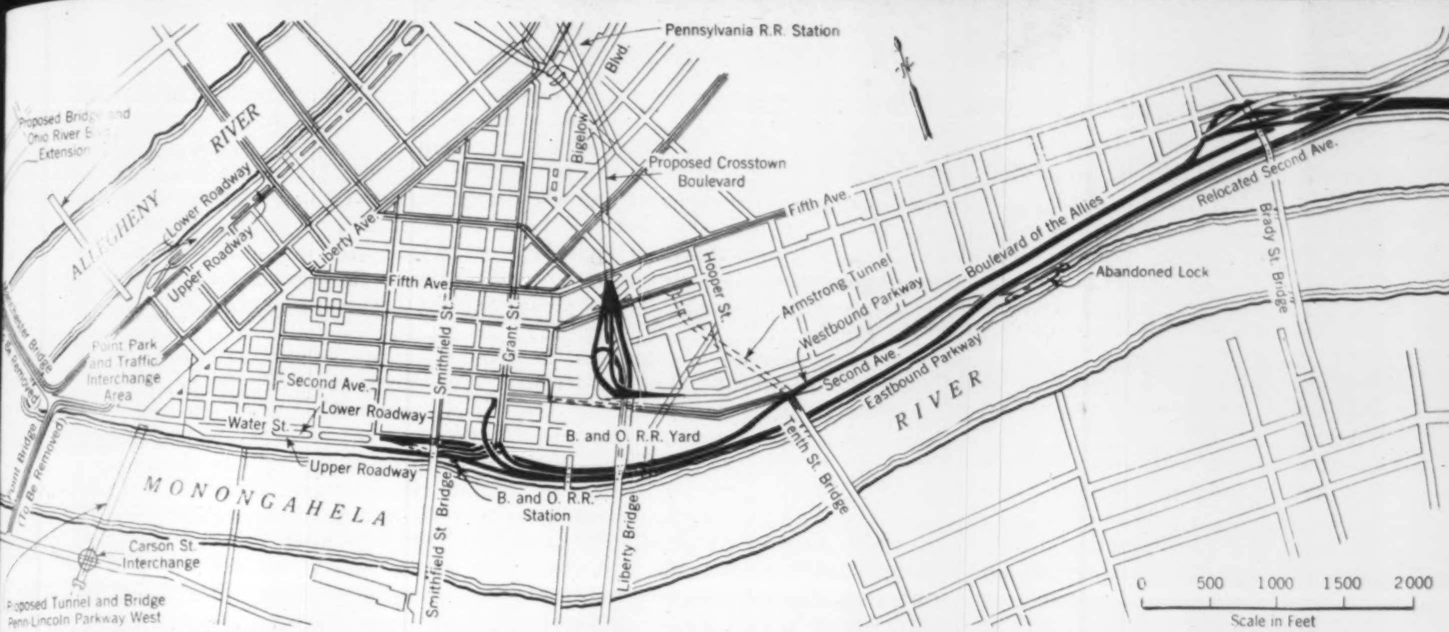

Pennsylvania R.R. Station
Proposed Bridge and Ohio River Blvd. Extension
RIVER
ALLEGHENY
Lower Roadway
Upper Roadway
Liberty Ave.
Bigelow Blvd.
Proposed Crosstown Boulevard
Fifth Ave.
Fifth Ave.
Relocated Second Ave.
Boulevard of the Allies
Abandoned Lock
Brady St. Bridge
Hooper St.
Armstrong Tunnel
Westbound Parkway
Smithfield St.
Grant St.
Point Park and Traffic Interchange Area
Manchester Bridge (To Be Removed)
Point Bridge (To Be Removed)
Second Ave.
Lower Roadway
Water St.
Upper Roadway
B. and O. R.R. Yard
Second Ave.
Eastbound Parkway
RIVER
Tenth St. Bridge
MONONGAHELA
Smithfield St. Bridge
B. and O. R.R. Station
Liberty Bridge
Carson St. Interchange
Proposed Tunnel and Bridge Penn-Lincoln Parkway West
0
500
1000
1500
2000
Scale in Feet

FIG. 1. **ADOPTED PLAN for Downtown Interchange provides smooth traffic flow on perimeter of Triangle and integrated traffic movement between Penn-Lincoln Parkway East and other major arteries. Average 24-hour traffic volume passing through and in immediate vicinity of Interchange, as estimated from comprehensive traffic studies, exceeds 170,000 vehicles.**

the Monongahela for both vehicular and streetcar traffic, but also is of secondary importance for the former. The same is true of the Brady Street Bridge, a much older structure and the next vehicular and streetcar crossing above Tenth Street.

Between the Boulevard of the Allies and the north bank of the Monongahela River there is a corridor of low-lying land on which is located Second Avenue and the main line of the Baltimore and Ohio Railroad. Near Grant Street this corridor has a width of about 800 ft but it narrows rapidly going upstream, and above the Tenth Street Bridge for a length of about 2,000 ft adjacent to an abandoned river lock it is very narrow, with a minimum width of about 140 ft. Above the lock the corridor widens again to about 800 ft at the Brady Street Bridge. A short distance upstream is one of the main plants of the Jones & Laughlin Steel Corp., located between Second Avenue and the river.

Intensive Traffic Studies Made

Early studies for the interchange layout were made with inadequate traffic data. Although much traffic information had been obtained over a long period of years by the City of Pittsburgh, by Allegheny County, and by the Department of Highways, it was considered insufficient to insure the best solution for a problem as intricate as that of the Downtown Interchange. Therefore in September 1945 an origin and destination count was made for the Triangle to obtain more complete information. This count was analyzed by the Traffic Bureau of the Department of Highways, and later, with particular reference to the Parkway Interchange, by a committee composed of traffic engineers representing the Department, the Public Roads Administration, the city, and the county. The work of this committee was supplemented at a later date by traffic studies of special points made by the Traffic Engineer of the City of Pittsburgh. As a result of this very detailed traffic analysis a comprehensive picture of traffic requirements was developed.

Among other things, this study showed the relatively large volume of traffic bound through the Triangle. Of a total volume of 28,000 inbound vehicles daily it is estimated that 13,000 will have destinations beyond the limits of the Triangle, or nearly 50 percent of the total, and an additional 4,000 will have destinations in the upper part of the Triangle to which they might be routed by the proposed Crosstown Boulevard. The advantage of such a Crosstown Boulevard has been recognized for many years, and all recent traffic studies have shown the necessity for it.

The magnitude of the traffic problem is shown by the total traffic volume. It is anticipated that the average 24-hour volume passing through and in the immediate vicinity of the interchange will exceed 170,000 vehicles. Of these, the parkway east of the interchange will carry 56,000 inbound and outbound vehicles, the Liberty Bridge 54,000, and the remainder will be divided among arteries of lesser importance. In addition to vehicular traffic there is a present 24-hour volume of more than 5,000 streetcars on streets adjacent to the parkway terminal.

Studies for the Downtown Interchange have covered a period of four years of intensive though intermittent effort. A great number of engineers on the staffs of both interested public agencies and private engineering firms have directed their attention to the problem, and an almost countless number of interchange schemes have been developed. Of these, three basic schemes were studied in great detail.

It was evident after analyzing distribution of traffic, construction cost, and other data for the three basic schemes that a satisfactory solution of the problem had not been found; but this complete information did define rather clearly the general requirements for a good plan. After several alternate studies including these requirements had been made, two plans were prepared for final consideration.

The Adopted Plan

According to the plan finally adopted (Fig. 1) the Penn-Lincoln Parkway enters the interchange about 1,400 ft upstream from the Brady Street Bridge. From a point a short distance east of the Brady Street Bridge to a point east of the Liberty Bridge the inbound and outbound roadways will be some distance apart, and the main line of the railroad and the upper part of the terminal yard will be located in the area between the two roadways. Second Avenue will be relocated from about the downriver end of the old river lock to the Jones & Laughlin Steel Corp. Plant.

This arrangement of parkway roadways, railroad tracks, and Second Avenue was decided on after studying many alternate arrangements through this area. Any plan involves great difficulties because of the very narrow width available for construction adjacent to the old river lock, but the chosen layout is the best, particularly when due consideration is given to the problem of maintaining railroad traffic and streetcar and vehicular traffic on Second Avenue during the construction period. The layout also has the advantage of maintaining property frontage along Second Avenue between the up-river end of the river lock and the Jones & Laughlin plant.

Near Brady Street the Boulevard of the Allies will be divided. The present boulevard will be used for inbound traffic and a new roadway will be constructed for outbound traffic. This separation of inbound and outbound boulevard traffic permits an orderly arrangement of connecting ramps between the parkway and the boulevard with good alignment and satisfactory grades. The Boulevard of the Allies will be widened between this interchange and the Liberty Bridge to a width of 46 ft between curbs. Although this increase of only 10 ft over the present minimum width is not as much as might be desired, it will provide a reasonably adequate roadway for four lanes of traffic.

Near the Liberty Bridge, direct connections will be made between the proposed Crosstown Boulevard and the Boulevard of the Allies at the present grade of the latter. The present connection from the Liberty Bridge to the Boulevard of the Allies for outbound traffic will remain, and a new connection will be constructed for inbound boulevard traffic destined to the bridge. By reason of the connections between the parkway and the Boulevard of the Allies at Brady Street, these connections to the proposed Crosstown Boulevard and the Liberty Bridge will serve both parkway and boulevard traffic. With the layout proposed, inbound traffic on the bridge will divide four ways—east to the Boulevard of the Allies, west to the same boulevard, through to the Crosstown Boulevard, and into the Triangle street system at Forbes Street and Sixth Avenue. The same connections are provided for outbound traffic.

Near Grant Street direct connections will be provided to the depressed roadway for through traffic. A ramp from the inbound parkway roadway will provide a direct connection to either Grant Street or the westbound surface roadway along Water Street. Another ramp starting at the intersection of the Boulevard of the Allies and Grant Street will eliminate any conflict from traffic making a left turning movement.

The terminal of the Baltimore and Ohio Railroad will be relocated in the area between the new parkway and Second Avenue. The plan permits satisfactory arrangement of the whole railroad yard with ample provision for vehicular driveways and a reasonably adequate plaza for taxi and public parking adjacent to the proposed new passenger station.

More detailed studies during the preparation of construction plans undoubtedly will result in some further revision in layout. Among other things it seems probable now that it will prove advantageous to use the present depressed roadway along Water Street for westbound traffic and construct a new roadway for eastbound traffic. Subject to this and other possible minor modifications, it is believed that the plan provides a satisfactory solution of the terminal program. The adopted plan has the following principal advantages:

An almost ideal distribution of traffic between the Boulevard of the Allies and the proposed parkway will be realized using both to their maximum efficiency and allowing an equal margin on each for traffic growth. The total east-west traffic is estimated at about 80,000 inbound and outbound vehicles daily. For the most effective use of both arteries this traffic should be divided in the approximate ratio of 40 percent on the boulevard to 60 percent on the parkway, since these percentages will be in the ratio of the number of lanes on each.

Every traffic movement, with the exception of a single minor one, will be direct and natural for all traffic destined to or originating on the parkway, the Boulevard of the Allies, the Liberty Bridge, and the Crosstown Boulevard. Traffic from either the parkway or the Boulevard of the Allies destined to the Liberty Bridge will turn through an angle of 270 deg at the bridge approach. All other movements, however, will follow direct and natural paths.

The plan is readily adaptable to stage construction, and it has an orderly arrangement which will result in roadways and structures of pleasing appearance.

Twin Two-Lane Tubes Carry 4,225-Ft Length of Parkway Under Squirrel Hill

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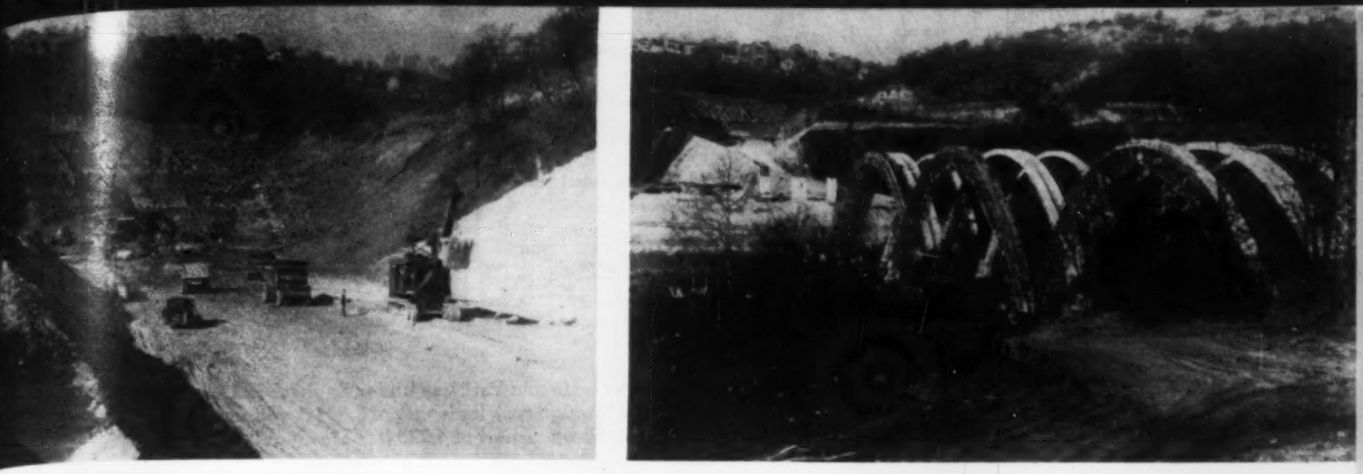
ONE OF THE MOST interesting features in the design of the Squirrel Hill vehicular tunnel is the ventilation system designed to vent exhaust gases from its 4,225-ft length. The possibility of fires must also be taken into account in the design of the ventilation facilities since experience has shown that about six vehicle fires occur in a traffic tunnel per million vehicles carried.

The location of the tunnel under Squirrel Hill, between Frick and Schenley Parks, with the west portal about $4^1/_2$ miles from downtown Pittsburgh, was determined by the route chosen for the Penn-Lincoln Parkway as it approaches Pittsburgh from the east. The tunnel provides twin tubes for the parkway, one eastbound and one westbound, with a two-lane roadway 24 ft wide between curbs in each tube.

Economical construction methods can be used as the tunnel is on a uniform grade and has areas available for the disposal of excavated material just beyond the portals. The grade is 2.5 percent running continuously down from west to east, and the alignment is straight. Ventilation equipment is housed in two buildings provided for the purpose, one at each portal.

For a length of 3,885 ft the tubes are to be bored through rock, but immediately adjacent to each ventilation building, where the depth of excavation is comparatively shallow, cut-and-cover methods are to be used. The rock through which the tunnel passes consists of shale with some sandstone, limestone and shaley limestone. Where the rock is not self-sustaining, or where it is blocky and seamy, steel arch ribs will be used for temporary support and steel posts will be placed at the sides where necessary to support the arch ribs.



APPROACH TO EAST PORTAL of Squirrel Hill Tunnel requires 980-ft four-lane bridge to carry parkway across Nine-Mile Run, about $5^1/_2$ miles east of downtown Pittsburgh. In view above, left, appears east portal of twin-tube tunnel being driven under suburban residential section. View above, right, shows arch ribs almost completed for $1,800,000 concrete bridge approaching tunnel from east, and at far left, excavation for tunnel portal.

Steel bracing is to be so installed as to form part of the permanent reinforced concrete structure. An attempt will be made to seal all water-bearing seams with grout. Excessive excavation beyond net lines will be rock-packed and grouted.

Space between the ceiling slab above the roadway and the arch roof is provided for use as a ventilation duct, air ports being formed in the ceiling slab at intervals. The headroom between top of roadway and bottom of ceiling slab is 14 ft minimum. A service walk 2 ft $7^1/_2$ in. wide runs along each tube on the left side facing in the direction of traffic. Niches for fire extinguishers and other equipment are installed on the sidewalk side of each tunnel.

The roadway is to be paved with vertical-fiber lugged paving brick laid with mastic joints on a sand and asphalt cushion. The curb is armored with steel and has a continuous open gutter under it. Tunnel sidewalls are finished with ceramic vitreous glazed tile.

Adequate Drainage Provided

As the tunnel lining is to be drained, it is not designed to withstand hydrostatic pressure. To provide adequate drainage the area under the roadway slab is to be filled with gravel or broken stone with a minimum thickness of 1 ft. A longitudinal drain pipe is to be installed below this area with transverse drains at intervals. Vertical sidewall drains of perforated transite pipe will be placed at each construction joint. These drains discharge into broken stone or gravel drainage ports under the walls, which in turn drain into the cross drains under the roadway. Ceiling drains consist of transite pipe leading to the roadway gutters on both sides of the tunnel. The roadway gutters discharge into catch basins installed along the curb at intervals and the basins are connected to the cross drains under the roadway. Manholes for cleaning the main drain are installed in the roadway. A six-way duct bank is carried under the sidewalk in the north tunnel and a three-way duct bank under the sidewalk in the south tunnel. Conduits are placed at the sides of the ventilation duct above the ceiling and also in the ceiling.

Two different types of reinforced concrete structures are used in the cut-and-cover sections of the tunnel: (1) a flat-roof section adjacent to the ventilation buildings and (2) an arch-roof type adjacent to the rock tunnel, in which an arch-roof section is also used.

Inasmuch as the characteristics of the tunnel lining must insure the strength and watertightness of the structure, the concrete for the lining must be dense and durable and shrinkage must be held to a minimum. The use of concrete which is easily worked in the forms is imperative, particularly where placing is difficult as in the arched roof. Air-entrained concrete is more suitable for this purpose because of its easier flowing characteristics. Another characteristic of air-entrained concrete—that of requiring little surface treatment after stripping of forms—was especially advantageous in the construction of the ventilation buildings, where a considerable area of outside walls requires architectural finish.

Because of these advantages, all concrete for the Squirrel Hill Tunnel has been specified to be air entrained, produced by the use of normal-strength portland cement with neutralized vinsol resin uniformly added to the clinker at the time of grinding to produce an air entrainment in the mortar of 18 percent ± 3 percent. Concrete for the tunnel sidewalls, arch, roof, cross passageway, roadway ceiling and cut-and-cover sections, and for the caissons under the west ventilation building, is specified to have a strength of 4,000 psi. In these parts of the structure coarse aggregate is limited to stone to minimize shrinkage and absorption, but elsewhere the alternative use of gravel or air-cooled furnace slag is permitted.

Ventilation buildings are designed as brick-faced with some architectural concrete in the upper portions and with concrete foundations. These buildings house the ventilating fans, two-way dampers and air ducts, transformers, switches and other electrical equipment. In front of each building, directly over the tunnel exit portal, there is an open-top structure with buffer walls and air openings to serve as an air trap. The corresponding structures over the entrances are roofed with glass so as to ease the transition which motorists undergo in passing from sunlight to tunnel lighting. The west ventilation building is supported on cylindrical piers and concrete footings on rock.

Design of an economical and adequate system of ventilation for the tunnel was based to a large extent on practical experience obtained from the operation of existing vehicular tunnels. A circular tunnel section provides two ideal locations for air ducts, one under the roadway (generally used to introduce fresh air) and the other above the roadway ceiling (generally used to remove the vitiated air). However, in tunnels in rock where a circular cross section cannot be used to advantage, it is more economical to omit the duct below the roadway and to use only the area above the driveway ceiling for ventilation purposes. The amount of space that can be economically utilized for ventilation is determined by comparing the first cost of construction with the operating cost of ventilating equipment, in which the cost of power is an important factor.

After considerable study, it was decided to make use of the driveway area of the Squirrel Hill Tunnel as

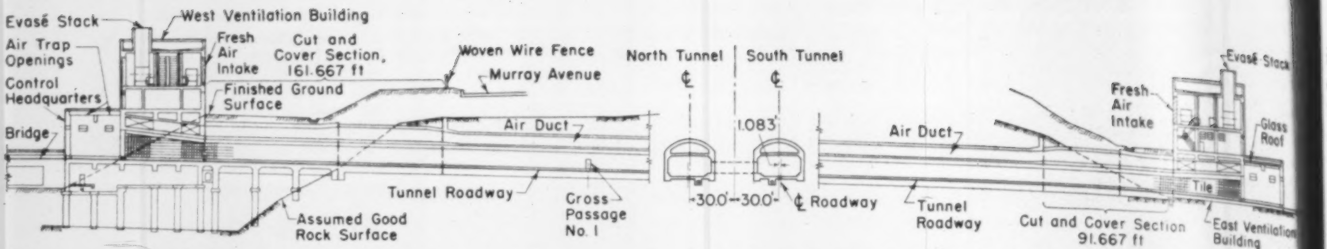


FIG. 1. TWIN TUNNELS, one for traffic in each direction, carry Penn-Lincoln Parkway under Squirrel Hill, between Frick and Schenley Parks about 4½ miles east of downtown Pittsburgh. Tubes are bored through rock for length of 3,885 ft, with cut-and-cover sections adjacent to ventilation buildings at each end to make up total tunnel length between portals of 4,225 ft. Elevation here shown is for north, or westbound, tube.

one duct to carry air longitudinally, and to use the area above the ceiling as the other duct. The ventilation system adopted provides economies in cost of construction and ventilation equipment, as well as reduced power costs for operation of equipment.

Certain practical factors limit the use of the driveway for an air duct, some of which are:

1. The allowable degree of atmospheric pollution in which a person may remain without harmful effects or discomfort for a given interval of time.

2. The allowable maximum longitudinal velocity of air movement in the driveway and the direction of this movement in relation to the direction of traffic.

3. Segregation and control of smoke from vehicle fires in the driveway.

For a traffic volume of 3,400 vehicles per hour ascending the 2.5 percent grade in the westbound tube of the Squirrel Hill Tunnel, the amount of fresh air necessary to dilute the exhaust gases to a safe maximum is about 275 cfm per lin ft of roadway. For the same traffic descending the 2.5 percent grade in the eastbound tube, the figure is 175 cfm. In other words, the total volume of fresh air necessary in the upgrade tube is about 1,162,000 cfm, and in the downgrade tube 740,000 cfm. The transmission and uniform distribution of volumes of air as great as these in ducts extending the entire length of the tunnel would require a great amount of power, since the power required varies directly as the cube of the length of the air duct.

It was therefore advantageous to ventilate each tube in two sections, one section starting at the entrance portal and extending to the midpoint of the tube, and the other section extending from the midpoint to the exit portal. Two ventilating buildings were therefore necessary—one at the east portal to provide ventilation for the easterly half of both tubes, and another building at the west portal to house the ventilating equipment for the westerly half of both tubes.

Ventilation of Westbound Tunnel

In the westbound (uphill) tunnel, the section of the duct above the roadway ceiling, from the east portal to the midpoint, is planned to be used as an exhaust duct, kept under negative static pressure by the operation of exhaust fans in the east portal ventilation building. Traffic entering this tunnel will create a longitudinal movement of air in the driveway in the direction of traffic, and this air movement will be augmented by the negative static pressure in the air duct above the roadway ceiling in the entrance section of the tunnel. Thus fresh air will flow in from the east portal and dilute the exhaust gases, and the vitiated air will be removed through ports in the ceiling slab giving entrance to the air duct, through which the vitiated air and gases will be conducted back to the exhaust fans and discharged through stacks at the top of the eastern ventilation building.

Under the heaviest traffic in the westbound tunnel it has been estimated that the concentration of carbon monoxide in the driveway will vary from zero at the portal to a maximum of four parts in 10,000 parts of air at the midpoint, which is the end of the entrance section. A vehicle will have traveled through an average concentration of not more than 1.6 parts of CO in 10,000 parts of air in traversing this 2,112 ft.

For the succeeding portion of the westbound tube, from the midpoint to the exit portal, the duct above the roadway ceiling slab will be used to introduce fresh air to the driveway, delivered by means of fans located in the west portal ventilation building. The fresh air is admitted to the driveway by means of ports in the ceiling and under a slight positive pressure. This air dilutes the driveway gases and is exhausted longitudinally through the driveway to the exit portal by means of the air movement created by traffic, augmented by the slight positive pressure at the ceiling air outlets. Ventilation of the eastbound (downhill) tube of the tunnel is similar to that for the westbound tube.

Eight large horizontal centrifugal fans of the backward curved-blade type, connected to two totally enclosed fan-cooled squirrel-cage motors by direct connection in some cases and by chain-drives in other cases, are to be installed, four in each of the ventilation buildings (two for fresh air and two for exhaust air). Each fan can be operated at three speeds—full, two-thirds full, and one-third full—and one or two fans can be operated on any duct, depending on the traffic volume.

Air traps are provided at the exit portals to counteract the effect of any wind movement toward the tunnel portal which would oppose the movement of the vitiated air out of the tube. Each air trap consists of an open roof structure over the exit roadway between the portal and the ventilation building where the two opposing air currents would meet. By creating an up draft, the traps prevent the wind from affecting the proper functioning of the mechanical ventilation.

Precautions Against Fire and Smoke

Experience has shown that most fires which occur in vehicular tunnels are minor, usually ignited brake bands, but some serious fires have occurred

BIDS WERE RECEIVED on July 23, 1948, for the construction of the tunnel proper, including the foundations for the ventilation buildings and the abutments for the bridge near the westerly portal, excluding the equipment, ventilation buildings, interior finish and paving. The contract was awarded to the low bidder, B. Perini & Sons, Inc., on the basis of their bid in the amount of $13,767,843.10. Construction work has started at the easterly portals and the contract time for this part of the work is two years.

in which the load and fuel burned, creating dense smoke and dangerous fire hazards to other vehicles. For this reason, a one-direction longitudinal movement of air in a tunnel driveway presents certain hazards. If a vehicle catches fire where the air is moving in the direction of traffic, the smoke of combustion travels with the moving traffic, ahead of the fire, creating a smoke hazard as well as cutting visibility. Or the air movement may carry the fire to preceding cars which have stalled.

It is therefore of prime importance to confine smoke and fire to a limited space. This aim can be accomplished in the Squirrel Hill Tunnel by an ingenious adaptation of reversible dampers in each ventilation building, so arranged that any tunnel air duct above the roadway can be maintained under either positive or negative air pressure. It has been demonstrated that if sufficient negative pressure is maintained in such an air duct above the roadway, the smoke arising from a fire will be drawn through the ports into the duct and hence will spread over a very restricted area in the driveway, thus maintaining visibility for fighting the fire as well as preventing the spread of fire to other vehicles. A U.S. patent has been granted on such a ventilation system to the writer jointly with his associate, Herbert G. Cruthers.

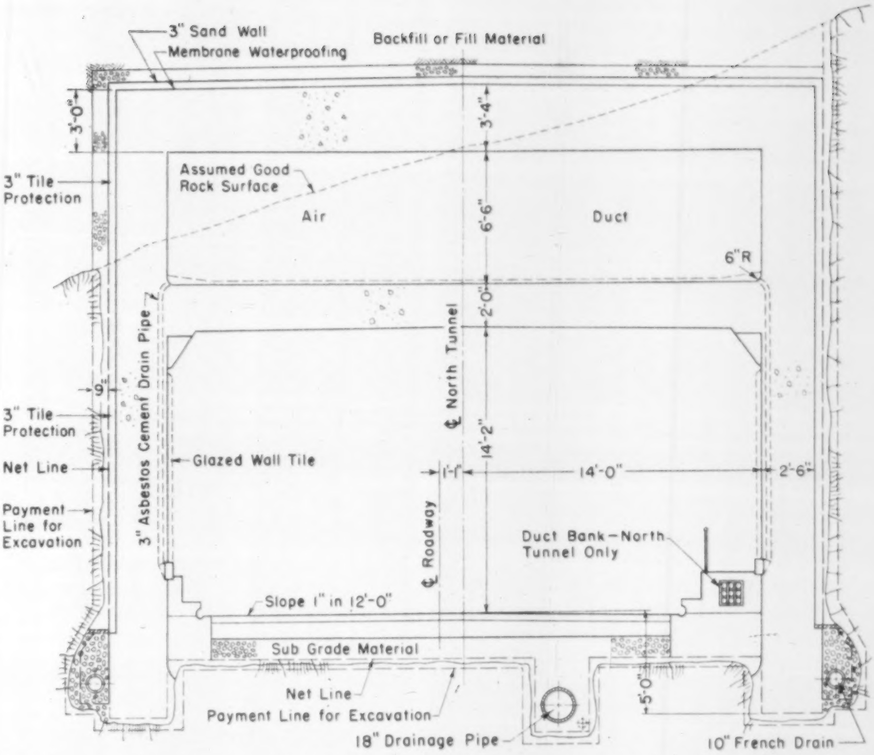


FIG. 2. **RECTANGULAR CUT-AND-COVER SECTION** is typical of tunnel structures used adjacent to ventilation buildings at each portal. Adjoining rectangular section at each end of tunnel, arched-roof cut-and-cover section extends for some 70 ft to connect with main rock section, likewise of arched-roof construction.

Fluorescent Lighting Permits Varied Intensities

Each tube will be lighted by two continuous lines of fluorescent lamps suspended from the ceiling, one near each side wall. The lamps will be in glass tubes 2 in. in diameter and about 12 ft long, supported end to end by metal brackets. Each bracket will contain a transformer to feed the lamps in the adjacent tube. The transformers will be fed from a series system of distribution by means of which it will be possible to vary the current through the lamps, thereby varying the intensity of the light, or compensating for the loss of light output of the lamps in cold weather.

Near the entrance portal and for a distance of 1,800 ft in each tunnel, the tubes will be fed in twelve groups with an independent control for each group so that the light intensity can be graduated down from a high intensity near the portal to the normal intensity in the remainder of the tunnel. High illumination near the portals is required in the daytime to overcome loss of visibility on entering the tunnel, but illumination is automatically reduced after dark to the normal tunnel intensity.

Power for lighting and ventilation will be furnished by the Duquesne Light Co. over two 22,000-v feeders, with a third feeder at 4,000 v for lighting only. Each 22,000-v feeder will have a transformer in each ventilation building to step the voltage down to 440 v for the ventilation motors and the lighting. All 22,000-v switching equipment and transformers will be supplied and operated by the power company.

Careful Scheduling of Operations Expedites Construction of Railroad Underpass

S. L. FULLER, M. ASCE
President, John F. Casey Co., Constructors, Pittsburgh, Pa.

PLANS for the Penn-Lincoln Parkway necessitated crossing the main line of the Pennsylvania Railroad at Edgewood Ave., about $1^1/_2$ miles east of the eastern portal of the Squirrel Hill Tunnel. At this point the Pennsylvania Railroad's five high-speed tracks are paralleled on the east by Edgewood Avenue, a 36-ft thoroughfare on which the Pittsburgh Railways operates two trolley tracks. (See Fig. 1.) On the west the railroad is paralleled by the tail track of the Union Switch and Signal Company's switching yard, and by Laurel Street, a 28-ft street giving access to the large private parking lot used by the employees of the U.S. & S. Co.

The designing engineers decided to underpass all these facilities, so the Department of Highways isolated this section of the parkway, developed

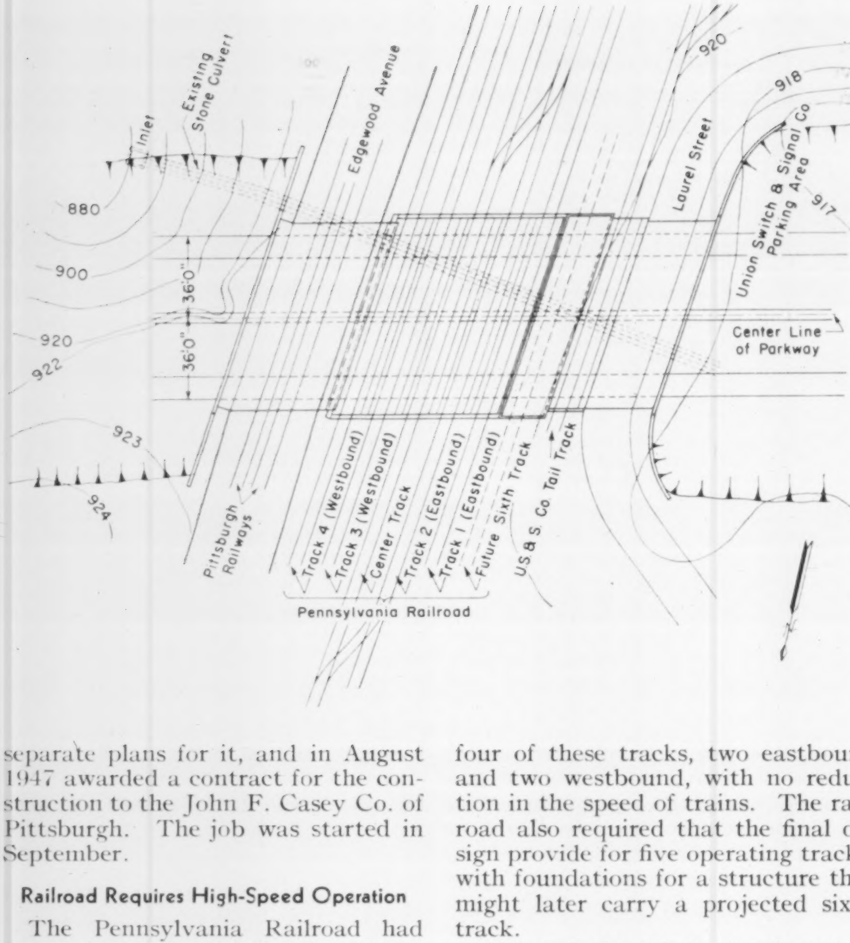

Inlet
Existing Stone Culvert
Edgewood Avenue
880
900
920
922
923
924
36'0"
36'0"
920
918
917
Laurel Street
Union Switch & Signal Co Parking Area
Center Line of Parkway
Pittsburgh Railways
Track 4 (Westbound)
Track 3 (Westbound)
Center Track
Track 2 (Eastbound)
Track 1 (Eastbound)
Future Sixth Track
US & S. Co Tail Track
Pennsylvania Railroad

FIG. 1. **ELEVEN INDEPENDENT PARALLEL SPANS are required where Penn-Lincoln Parkway underpasses main line of Pennsylvania Railroad, as follows:** Two spans for **Edgewood Avenue; five spans for active tracks of railroad, that is, one span for each track; one span for projected sixth track; one span for tail track of Union Switch and Signal Co.; and two spans for Laurel Street.**

separate plans for it, and in August 1947 awarded a contract for the construction to the John F. Casey Co. of Pittsburgh. The job was started in September.

Railroad Requires High-Speed Operation

The Pennsylvania Railroad had five active tracks in operation at the point of crossing and required that at all times during construction uninterrupted traffic be maintained on four of these tracks, two eastbound and two westbound, with no reduction in the speed of trains. The railroad also required that the final design provide for five operating tracks, with foundations for a structure that might later carry a projected sixth track.

Although the existing track centers varied from 12 ft 9 in. to 13 ft 6 in., the track slabs in the final construction had to be centered for a uniform 14-ft 0-in. track spacing. As the center of westbound track No. 4 was to remain the same, this increase threw all of the new track centers to the west. This change was decidedly advantageous, as it provided a few more inches of elbow room for construction. It of course required the building of the west spans first. (See Fig. 1.)

The Highway Department made an agreement with the Borough of Edgewood to detour vehicular traffic entirely off of Edgewood Avenue when necessary, and the Pittsburgh Railways agreed to single-line their trolleys on relocated temporary surface tracks when necessary.

On the west side of the Pennsylvania Railroad the project work required the use of most of the parking lot of the Union Switch & Signal Co. The company agreed to abandon temporarily the use of the lot but required that minimum service be maintained through the main switch leading to the yard tracks.

Eleven Spans Included in Project

The complete grade-separation project requires the construction of eleven parallel spans (Fig. 1), each constructed entirely independent of adjacent spans. Commencing at the south, these are: Two sections for the Laurel Street Bridge; a bridge for the U.S. & S. tail track; a bridge for the Pennsylvania Railroad's future sixth track; five spans for active railroad tracks; and the two sections of the Edgewood Avenue Bridge.

The concrete foundations rest on miscellaneous fill—such as cinders and slag—and some natural clay. The designs for all the structures called for reinforced concrete foundations supported on steel bearing piles about 40 ft long, driven to refusal in shale. Under the railroad structures the loading is 82 tons per pile, and the design called for driving 14-in. 89-lb CB sections. Under the highway structures the loading is 62 tons per

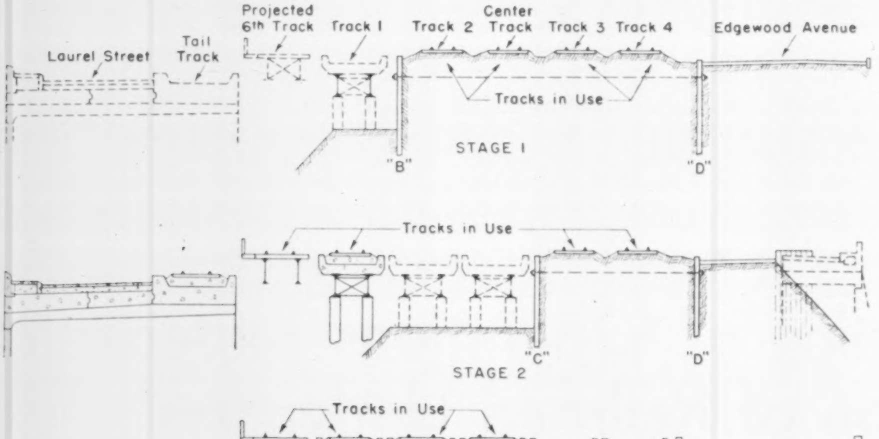

Projected 6th Track
Track 1
Track 2
Center Track
Track 3
Track 4
Edgewood Avenue
Laurel Street
Tail Track
Tracks in Use
"B"
"D"
STAGE 1
Tracks in Use
"C"
"D"
STAGE 2
Tracks in Use
STAGE 3
Future 6th Track
Track 1
Track 2
Center Track
Track 3
Track 4
STAGE 4

FIG. 2. **CROSS SECTIONS SHOW FOUR STAGES into which construction work on underpass for Penn-Lincoln Parkway is divided. Stage 4 also represents finished cross section of project.**

pile and the design called for driving 12-in. 53-lb CB sections.

For the support of each of the five active Pennsylvania tracks, a typical reinforced concrete cast-in-place through floor slab, supported on structural steel rigid frames on reinforced concrete footing slabs, was selected. The abutment wall was provided by driving a row of MZ-38 steel sheetpiling with a specified length of 36 ft, giving a penetration of 7 ft below the bottom of the footing. Thin reinforced concrete curtain walls span the spaces between the structural steel columns. For the projected sixth track, the same foundation was provided, but the overhead span is supported on three lightweight plate girders, to provide support for a thin cover slab of concrete-filled steel grating, as no load is contemplated in this area. The abutments for this structure are designed as cantilever retaining walls.

For the Laurel Street Bridge, the U.S. & S. Co. tail-track bridge, and the Edgewood Avenue bridge, conventional rigid-frame reinforced concrete structures were specified in the design.

The original scheme contemplated supporting two tracks at a time on the existing ground, held in place between two rows of M-116 steel sheetpiling. The two rows of piling would be held together by a series of 1-in. round rods, 32 in. from center to center, just under the tracks. This scheme would have required the driving of four separate rows of supporting piling and would have necessitated five main stages of construction.

By securing the permission of the U.S. & S. Co. to shorten its tail track and support the stub end on a temporary trestle, it was possible to evolve a simplified schedule consisting of only four stages of construction and thus to advance the completion of the whole structure by at least two months. (See Fig. 2.)

Under the revised construction program, four pair of tracks were tied together in Stage 1 instead of two pair. To give the supporting rows of piling more stiffness, MZ-32 Z-piling was used instead of M-116. Also $1^{3}/_{4}$-in. round rods, spaced on about 10-ft centers and tied into heavy steel H-beam wales were used in lieu of the 1-in. round rods spaced on 32-in. centers previously suggested. H-beams were driven beyond the railroad right-of-way at Edgewood Avenue as anchors for all supports (Fig. 2, Stage 1, Row "D").

The contractor elected to use only crawler-type equipment, and at no time to occupy any of the operating railroad tracks with flanged-wheel equipment. The method of construction adopted has resulted in the least possible interference with railroad traffic; no turnouts or crossovers have been required; each track has been kept intact; and the detours required, obtained by long throws of track alignment, have necessitated the issuance of no slow orders at any time. As far as the contractor's work is concerned, for only a comparatively few days of the entire job was it necessary to use flag protection for the safety of the railroad or the contractor's employees.

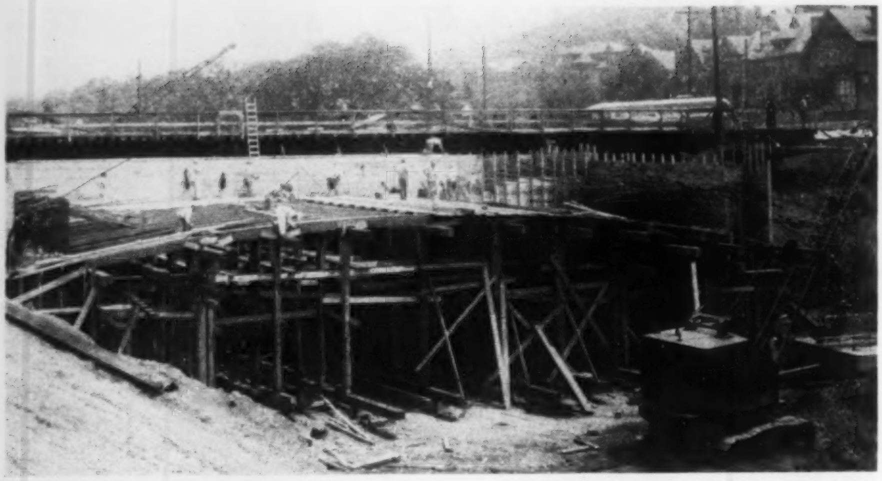
MOST HAZARDOUS PART of underpass job is construction of permanent bridge structures to carry center tracks of Pennsylvania Railroad over Penn-Lincoln Parkway. This Stage 2 construction was accomplished in space 26 ft wide while two tracks on each side carried trains at high speed. In background, crane at track level drives bearing piles in north abutment. At left may be seen girder forming permanent support for Track 9 and at right row of MZ-32 piling supporting inner side of Track 3 (See Figs. 1 and 2.)

First Stage of Construction

Before construction could start on Step 1 of the main project, the railroad relocated its eastbound traffic onto the former No. 2 track and the center track (Fig. 2). First, a row of MZ-32 piling (Fig. 2, Stage 1, Row "B") was driven parallel to the railroad track for the width of the required cut. Taking advantage of the stiffness of this piling, excavation was carried down 6 ft on its outer side to permit the driving of the rods to tie the piling to anchors on the Edgewood avenue side, where a trench had already been dug. The $1^{3}/_{4}$-in. round rods were then driven through holes burned in the piling about 5 ft from the top. As each 20-ft length of rod was driven, another section was attached by means of a specially made heavy tapered end sleeve, and the driving continued until the entire 60-ft length of rod had been driven.

These rods were held to line and grade with varying degrees of accuracy. As the rods were driven,

GIRDER FOR CENTER TRACK BRIDGE is set without interruption to rail traffic. Work under Stage 2, completed November 1, permits shifting of rail traffic to Track 2 and center track, so that bridges for original westbound tracks can be built under Stage 3. (See Fig. 2.)



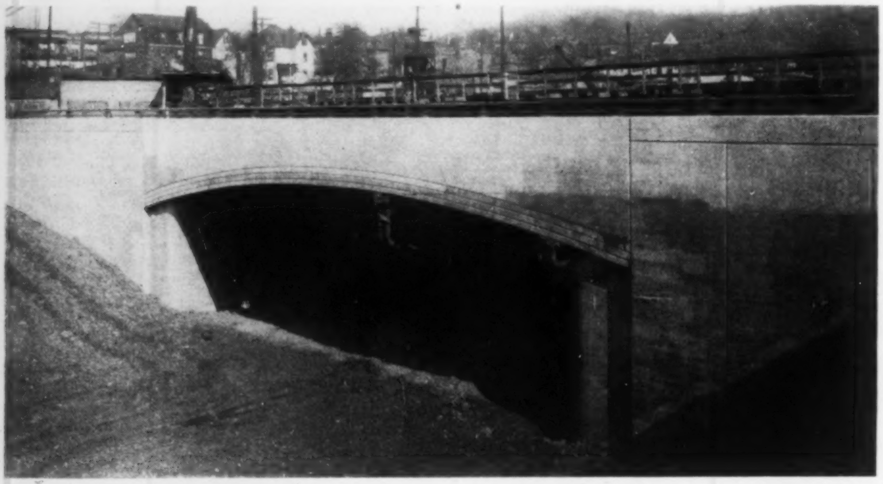
FALSEWORK FOR LAUREL STREET bridge deck is placed in Stage 1, in preparation for pouring of rigid-frame reinforced concrete structure. Similar structures are used to carry tail track of Union Switch & Signal Co. and Edgewood Avenue over Penn-Lincoln Parkway.

some struck parts of old structures, trestles, boulders, etc., and veered off so that they had to be pulled out, relocated to one side, and redriven. Finally all eight of the tierods were driven on acceptable lines and grades. Then a 12-in. CB section was driven each side of each rod on the Edgewood Avenue end, to act as an anchor. A washer was placed on the end of each rod, a nut drawn up, and concrete poured to provide sufficient buttressing for the beams. Similar CB wales were placed along the row of piling on the west side and the rods tightened by nuts on that side also. Thus four railroad tracks were supported for uninterrupted traffic until the completion of the first construction stage. Temporary piling was then driven along the edge of the roadway for the future parkway on the west side of the tracks so that excavation could be made for foundations. Bearing piles were driven, foundations poured, and the superstructure was erected by conventional methods.

With the permanent supporting structure for Track 1 completed and a temporary structure provided on the line of the projected sixth track, the railroad rerouted its eastbound trains on these two structures, and so released the original No. 2 and center tracks for construction under Stage 2.

Second Stage Was Most Hazardous

Stage 2 was the most hazardous period of the work for it required the construction of two entire bridges in a space 26 ft wide, with two tracks on each side carrying trains at high speed. The method of procedure was similar to that used for Stage 1. A crawler-type crane was located at track grade in the center area for driving permanent Z-pile abutments. The $1^3/_4$-in. round rods were uncoupled and their first sections backed out, and the piles in row "B" were pulled and redriven at "C." (See Fig. 2, Stage 2.) Wales and tierods were replaced on the west side of Track 3 to provide support for the two westbound tracks Nos. 3 and 4, while excavation and construction progressed on the permanent spans to carry the No. 2 and center tracks. After the row "C" piling has been driven and tied back, the grade below the structures completed in Stage 1 was used as the access route for men and materials during Stage 2 construction so as to avoid the hazard of working over or around the main-line tracks at grade. Excavation was removed, and forms and reinforcing steel and concrete were delivered entirely underneath the trains running on the temporary eastbound tracks.



RIGID-FRAME REINFORCED CONCRETE STRUCTURE carries Laurel Street over Penn-Lincoln Parkway. All underpass structures have reinforced concrete foundations supported on steel bearing piles about 40 ft long, driven to refusal in shale.

Construction Stages 3 and 4

Before the start of Stage 3, the east half of the Edgewood Avenue structure was constructed in a conventional manner. Following completion of Stage 2, traffic on the two westbound tracks was thrown over onto the middle tracks so that the bridges for the original westbound tracks could be built under Stage 3. As of November 1, 1948, Stage 2 has been completed and work started on Stage 3. Stage 4 should be finished by March 1, 1949. In Stage 3 the temporary sheetpiling in line "C" will be pulled and the permanent Z-pile abutments driven, eliminating all necessity for the temporary support of any railroad track. The excavation of the bore will be entirely completed under the railroad right-of-way and Edgewood Avenue, and the permanent structures for the two westbound tracks and for the west half of Edgewood Avenue will be finished.

With all five permanent railroad spans complete, the railroad will replace its tracks in their final location. (See Fig. 2, Stage 4.) Since there will then be no further use for the temporary girder crossing which the contractor erected in Stage 1 on the location of the projected sixth track, this temporary crossing will be removed and the final steel structure erected there.

When some 27,000 cu yd of required excavation east of Edgewood Avenue has been completed and the material moved through the parkway underpass into the embankment west of the structure, the project will be finished. The contractor can then apply for release from the $1,000,000 bond which had to be furnished to protect the Pennsylvania Railroad from possible loss or damage during the progress of the work.

Hindcasting Technique Provides Statistical Wave Data

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Scripps Institution of Oceanography of the University
of California, La Jolla, Calif.

IN THE PAST it has rarely been possible to base the design of structures affected by wave action upon quantitative estimates of essential wave characteristics, such as height, period, and direction. Consequently some structures have failed to produce the desired results, and some have collapsed under the action of the waves. Also, material and construction time have been wasted on structures designed to withstand far greater wave action than they will ever encounter.

Shoreline and beach-profile changes are due partially to the movement of sand by the orbital motion of the water in waves and partially to sand transport by longshore currents. Prevailing and extreme wave conditions are basic factors used in applying recently developed theories to obtain quantitative estimates of sand movement.

This article is a contribution from the Scripps Institution of Oceanography, New Series, No. 354. The work described represents results of research carried out for the Hydrographic Office, the Office of Naval Research, and the Bureau of Ships of the Navy Department under contract with the University of California.

The value of a projected breakwater depends upon its sheltering effect and its effect upon longshore currents and sand transport. Statistical wave data aid in determining the desirability of the proposed plan and in amending it, if necessary, before construction is undertaken. In harbor planning based on model studies, statistical wave data are utilized in calculating the dimensions of the waves used in the model.

During the war a method of forecasting wave characteristics along

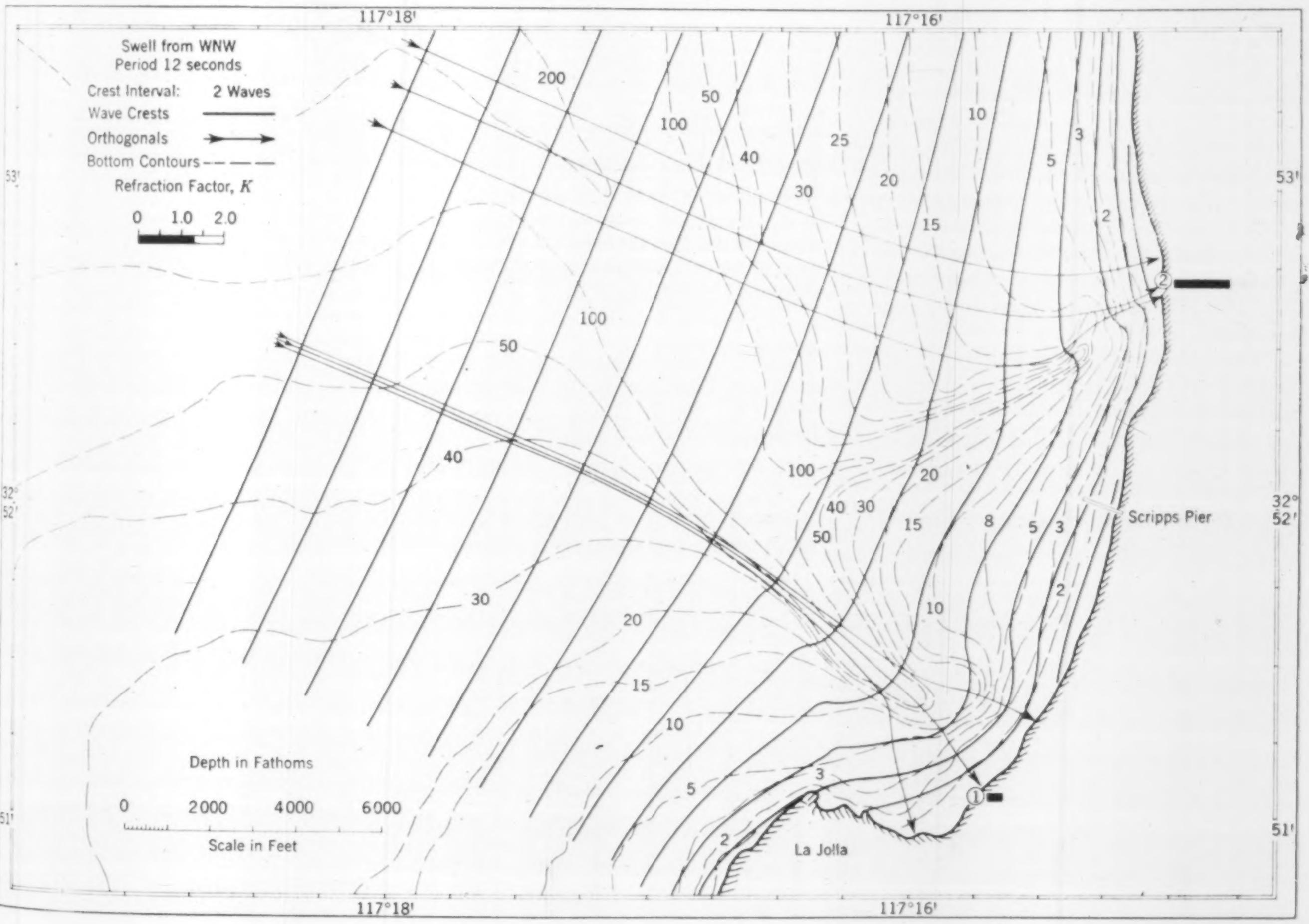
117°18'
117°16'
Swell from WNW
Period 12 seconds
Crest Interval: 2 Waves
Wave Crests
Orthogonals
Bottom Contours
Refraction Factor, K
0 1.0 2.0
53'
32° 52'
51'
Scripps Pier
La Jolla
①
②
Depth in Fathoms
0 2000 4000 6000
Scale in Feet
200
100
50
40
30
25
20
15
10
8
5
3
2

FIG 1. SIMPLIFIED REFRACTION DIAGRAM for Scripps Beach 16 miles north of San Diego, Calif., illustrates effects of submarine canyon off Sta. 1 and submarine ridge off Sta. 2 on wave divergence and height of breakers.

beaches where amphibious landings were to take place was developed by the Scripps Institution of Oceanography and the Department of Engineering, University of California, and the Woods Hole Oceanographic Institution under contract with the U.S. Navy and War Departments. Complete treatment of the theory and forecasting techniques used can be found in publications of the U.S. Hydrographic Office.

As first suggested by Dr. H. U. Sverdrup, then Director of Scripps Institution of Oceanography, wave forecasting techniques can be applied to the computation of wave characteristics by using historical weather maps which are now available for the Northern Hemisphere for a period of 40 years prior to 1939. In brief, the characteristics of waves arriving at a point in deep water offshore may be computed from quantities which are readily obtained from weather maps. These quantities are the wind velocity, the wind duration, and the size and position of the area over which the wind blows.

Effect of Bottom Contours

Because of the effect of the bottom, significant changes begin to occur when the waves enter water that is shallower than one-fourth the horizontal distance between adjacent crests, and the waves eventually "break" near the shore. The greatest changes in waves take place over irregular bottom contours. For example, over submarine canyons divergence occurs, wave crests are stretched laterally and their heights decrease. Over submarine ridges the converse is true (Fig. 1).

Final breaker height can be determined by constructing a refraction diagram as explained in "Refraction of Ocean Waves; A Process Linking Underwater Topography to Beach Erosion," by W. H. Munk and M. A. Traylor (*Journal of Geology*, Vol. 55, No. 1, 1947, pp. 1–26).

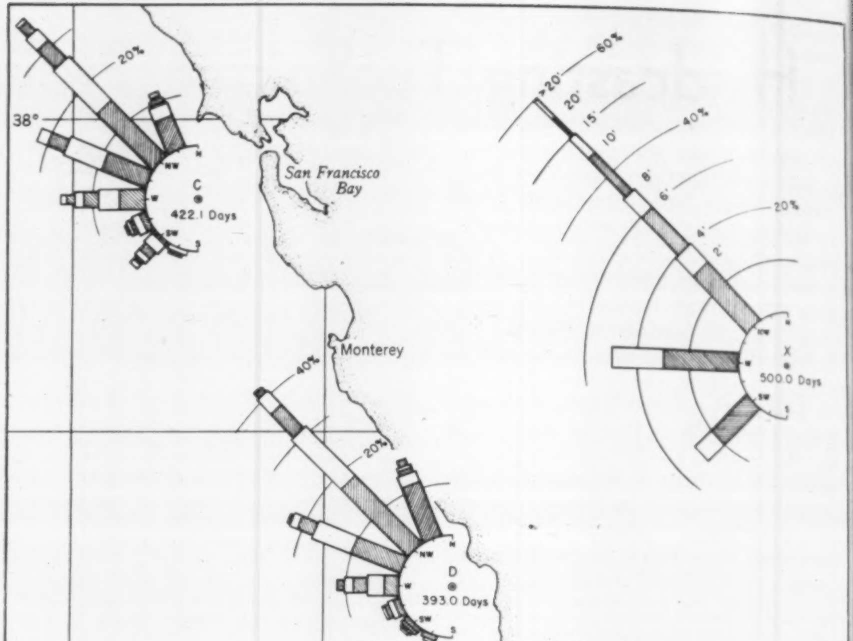

FIG. 2. DEEP-WATER WAVE HEIGHTS AND DIRECTIONS for winter months (December-March inclusive, 1936, 1937, 1938) are being used by Corps of Engineers in planning of shore and harbor protection structures on California coast. Diagram is from "A Statistical Study of Wave Conditions at Five Open Sea Localities Along California Coast, 1947," report prepared by Scripps Institution of Oceanography of University of California for Corps of Engineers, Los Angeles District.

Figure 1 is a simplification of a refraction diagram from Munk and Traylor for the area near the Scripps Institution of Oceanography for waves of 12-sec period from the WNW. The divergence over the submarine canyon off Sta. 1 is indicated by the spread of the orthogonals to the wave crests and results in waves breaking at 35 percent of the breaker height that would have occurred if there had been no refraction (refraction factor $K = 0.35$). The convergence over the submarine ridge off Sta. 2 results in waves breaking at 135 percent of their unrefracted breaker height ($K = 1.35$).

Waves of the same average characteristics may extend over a large area in deep water off a coast. Thus, wave characteristics at several points on the shore can be obtained from the deep-water data at one point offshore using the theoretical graphs and refraction diagrams for each direction and period under consideration.

Computed Versus Observed Wave Data

There are three methods of obtaining wave data—visual observation, instrumental observation, and computation. Several years of almost continuous observations are necessary

TABLE I. DATA FOR SAMPLE STATION X IN FIG. 2. TOTAL DAYS = 500

(1) Wave Height in Ft	(2) Percentage of Total Days When Wave Height Is Less Than Value in (1)				(3) Actual Number of Days When Wave Height Is Less Than Value in (1) (Percentage Times 500)			
	NW	W	SW	All Directions	NW	W	SW	All Directions
2	15	15	10	40	75	75	50	200
4	20	25	15	60	100	125	75	300
6	30			70	150			350
8	35			75	175			375
10	45			85	225			425
15	50			90	250			450
20	55			95	275			475
+20	60			100	300			500

NOTE: Directions NW, WNW, W, WSW, and SW include a range of $11^1/_4$ deg on each side. Direction NNW includes waves from $326^1/_4$ deg to 360 deg. Direction SSW includes waves from 180 deg to $213^3/_4$ deg.

to give reliable mean and extreme wave conditions which may be expected at any point on a coast. For a given point, visual or instrumental observations would have to be taken over this entire period. The data obtained are generally valid only in the immediate vicinity so that both methods are expensive when data for a large number of localities are needed. Both methods fail to give accurately the direction from which the waves approach.

The computational method has the advantage of requiring only several months to compute data covering several years of time. Onshore data for many neighboring coastal locations may be obtained from the deep-water data at one point and the wave direction can be accurately computed. Because visual observations vary considerably depending upon the experience of the observer, the computational method is more accurate. Computed data also compare favorably in accuracy with instrumental observations.

Applications

Many uses for computed data have been found. Munk in "Wave Action on Structures" (*Petroleum Technology*, December 1947) has made a study of the forces due to waves on objects such as piling. In the examples cited he computes the dimensions of the waves at the given locality by the hindcasting technique.

The hindcasting technique has been used at the Scripps Institution of Oceanography in two studies for the U.S. Navy and one for the U.S. Army. The Navy projects were statistical studies of wave conditions at certain open-sea localities and in given sheltered areas to aid in the design of seaplane hulls. The Army project was a study of wave conditions at five open-sea localities along the California coast. Similar studies may be made for any ocean area or for any natural or artificial lake for which wind data are available.

Data from the project undertaken for the Corps of Engineers, Los Angeles District, are being used by the Corps to aid in the planning of shore and harbor protection structures on the California coast. The Engineers are constructing refraction diagrams to determine the onshore wave characteristics from the deep-water data. Figure 2, based on data from the report on this project, shows the wave height and direction for winter months along the California coast. The frequencies of height and direction for waves of all periods are given by percent. If two or more wave trains appeared on the same day, each is accounted for in the frequency diagram. Thus, the total number of days upon which the percentages are computed varies from station to station and differs from the actual number of days in the given season. Going northward along the coast, the shift in predominant wave direction from northwest to west and the increase in percentage of larger waves reflects the northerly position of the storm tracks. However, the five stations at which computations were made, three of which are shown in Fig. 2, are located close enough to each other so that all coastal points are effectively accounted for.

From the wave energy distribution, the average work done by the waves as they pass a fixed line of given length parallel to the wave crests was also computed as a function of the wave period. This work may prove to be a useful quantity in the study of sand transport and wave erosion, inasmuch as the action on the sand in and near the breaker zone is closely related to the work expended.[1]

Two forecasters and three statistical clerks can compute, in about four months, the deep-water wave characteristics over a three-year period for the California coast. It is estimated that for an average station it would require about two months for one person to draw the necessary refraction diagrams and compute from the deep-water data the wave characteristics for a given coastal station.

A specific example will illustrate the application of the statistical wave data and refraction diagrams to an erosion problem. After construction of a breakwater on a short segment of the California coast occasionally subjected to high waves, most of the beach sand was moved into the lee of the structure by the action of waves and longshore currents. Subsequent attacks caused a recession of the beach and extensive property damage. This movement could have been predicted by using statistical wave data and refraction diagrams.

Refraction diagrams have shown that these exceptionally high waves are caused by strong convergence of the energy of wave trains from certain directions and with certain periods, as they move shoreward along the ridge at the edge of a submarine canyon. Statistical wave data confirm the actual observation that these critical waves occur relatively infrequently. In view of these facts, consideration is now being given to altering the original design of a proposed extension to the existing breakwater in order to enlarge the harbor and enclose the eroding area.

Conclusion

A speedy, accurate, and inexpensive method does exist for obtaining wave data. Data of this type are becoming increasingly important and are finding wider application in problems concerning beach and shoreline engineering.

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[1] "Littoral Transport on the California Coast," by R. O. Eaton, presented at Pacific Coast Meeting of American Geophysical Union, February 13–14, 1948, at Berkeley, Calif.

Crane with 80-Ft Reach Places Forms on Airport Project

LONG REACH of truck-mounted crane equipped with 65-ft boom and 15-ft jib extension facilitates placing of concrete forms for administration building of new Seattle-Tacoma Bow Lake Airport. Contractor for airport, now under construction approximately halfway between Seattle and Tacoma, Wash., is Lease & Leigland Co., of Seattle. Machine pictured is 20-ton Lorain Moto Crane MC414.

Spiral Flow Increases Capacity of Vertical Discharge Shaft

M. MORTARA

Consulting Engineer, Baltimore, Md.

IN REHABILITATING one of the hydroelectric plants wrecked by the German army in Central Italy during its retreat, the opportunity arose to increase the peak capacity by 25 percent by making minor modifications in the hydraulic works, which were practically undamaged. To secure the increased capacity it was necessary to raise the spillway crest at the forebay and to increase by 25 percent the discharge capacity of the spillway itself and of the outlet works, which consisted of a vertical shaft and a horizontal tunnel, located approximately 60 ft below the spillway crest.

Since all these works were underground in solid limestone rock, it would have been very expensive to increase their dimensions. A careful study of the problem indicated that the desired results could be obtained at a moderate cost by installing a syphon hood on the spillway and modifying the hydraulic performance of the vertical shaft by a novel design, based on the generation of a stable vortex within the shaft by guiding the water stream tangentially to its lip.

The forebay and outlet works, after modification, are shown in vertical sections in Fig. 1; the shaft is unlined and its diameter varies from 15 ft at the top to 12.4 ft at the bottom. The original discharge capacity, which was approximately 1,400 cfs, has been increased to 1,750 cfs.

Studies made by means of models at the Institute of Hydraulics of the University of Naples showed that the discharge capacity could be increased as required by an appropriate determination of the shape and slope of the spiral channel guiding the water to the shaft. Under such conditions, a stable vortical flow is generated, whereby the water nappe moves on a helical path along the walls of the shaft. This performance is shown clearly in Fig. 2 (*a*), which is a photograph of the definitive model (sca 1:20) used for the tests. A hollo space remains in the center of t shaft, as far down as the water lev of the outlet tunnel, and its effe is to reduce considerably the a entrainment, thus eliminating t pulsations and irregularities of flo observed in similar installations wit free-fall discharge.

A photograph taken from the to of the actual shaft in operation, Fig. 2 (*b*), shows that the nappe is not as smooth as in the model because of small rock projections in the unlined surface of the shaft. However, the performance of the discharge works as a whole was found to be in good agreement with the model. The highest discharge available for test after completion of construction was approximately 1,600 cfs, that is, 15 percent above the original capacity. Operation under such conditions indicated that the expected increase of 25 percent will be easily reached.

In view of the success of this installation, model tests have been made on shafts having ratios between depth and diameter of 15, 22 and 44; these tests have proved that, by proper design of the inlet channel, the vortex can be made to extend down to the bottom of the shaft, even with the highest ratio. This

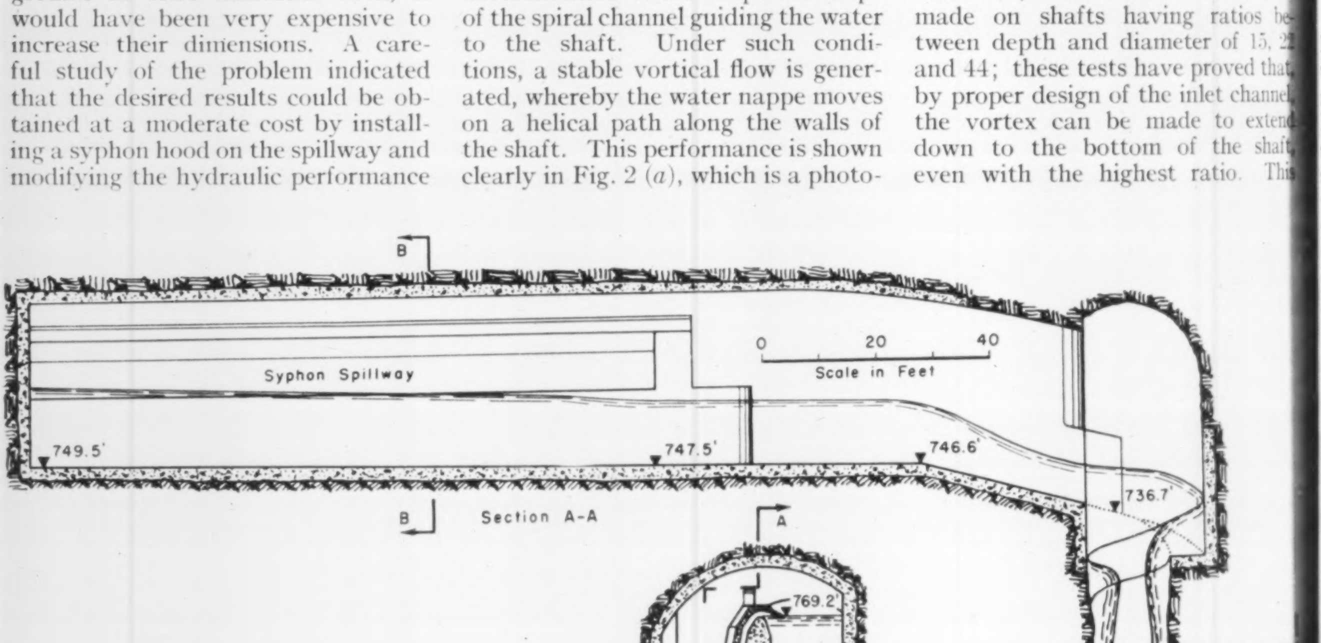

FIG. 1. VERTICAL SECTIONS of spillway and discharge works show syphon hood added over spillway crest and water profile after redesign of shaft to induce stable vortex providing 25 percent increase in its capacity of discharge. Installation is in Pescara No. 1 hydroelectric project in central Italy.

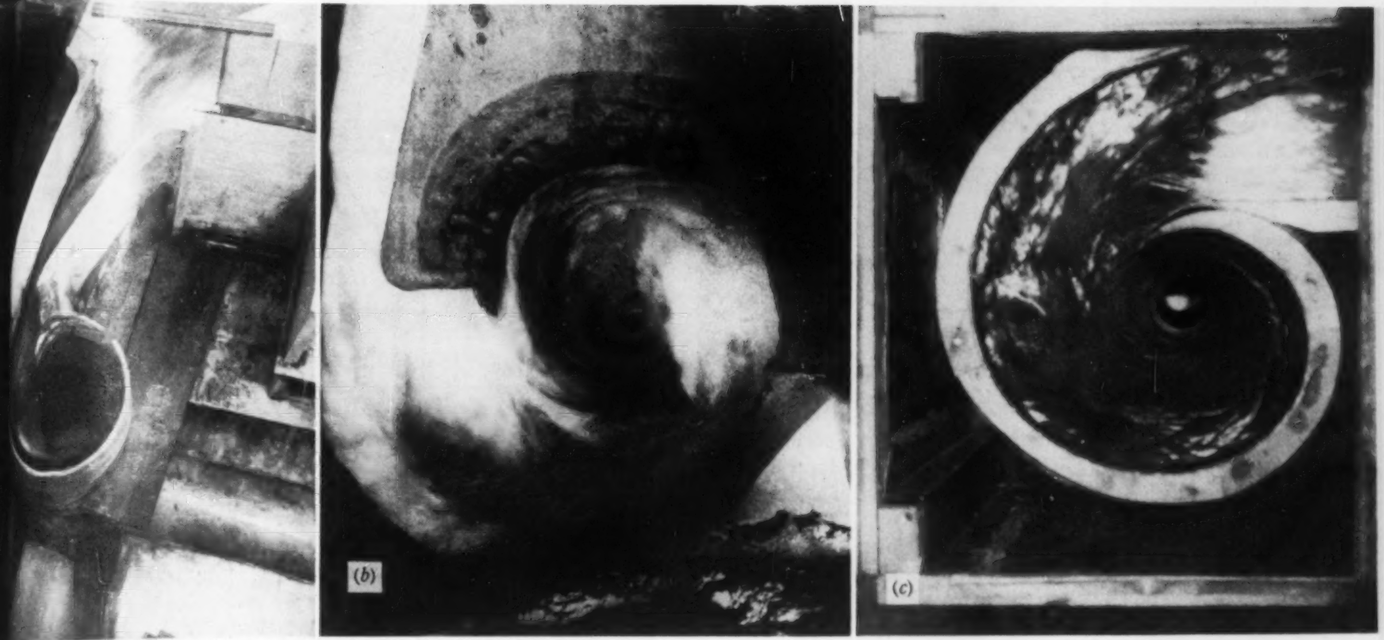

FIG. 2. **REDESIGNED SPILLWAY DISCHARGE SHAFT** generates stable vortex by guiding water stream tangentially to lip. Operation of definitive model (*a*), to scale of 1:20, presages behavior of actual structure (*b*) in which, however, nappe is less smooth because of small rock projections in unlined shaft. Operation of another model (*c*) shows that vortex can be made to extend down to bottom of shaft even with much higher ratio of shaft depth to diameter.

condition is apparent in Fig. 2 (*c*), a photograph of one such model in operation. Further tests are being made for a new project, including a discharge shaft having a depth 200 times its diameter.

As compared with the conventional design, the new type of shaft has two principal advantages: (1) Considerably greater capacity for a given diameter of shaft; and (2) much more regular flow and absence of occasional formation of partial vacuum, with consequent elimination of the major cause of scouring action and damage to the inner surface and lining of the shaft and tunnel.

The works described are part of the hydroelectric project Pescara No. 1, owned by the Società Meridionale di Elettricità, Naples, Italy. The new design of the discharge shaft, for which an Italian patent has been granted, was conceived and developed by Dr. Carlo Drioli, Director of Hydraulic Construction of that company.

New Highway Traverses Difficult Route to India Border Province

HAILED AS INDIA'S greatest postwar engineering achievement, the 65-mile Pathankot-Jammu road connects India and Kashmir for military security and interchange of trade. In spite of innumerable engineering complexities and an unprecedentedly severe winter flood, not to mention the bullets of raiders from across the frontier, the road was completed in 3½ months, said to be a record. Three major bridges, 15 minor bridges, 173 culverts and innumerable causeways are required to carry the road through rolling country with swift torrents, many small streams and three large rivers—the Ravi, Ujh, and Basantar. The amount of labor spent in constructing the bridge over the Ravi River alone is estimated to be enough to build an ordinary road 150 miles long. In building the entire route, nearly 18,000 tons of cement, 5,000 tons of steel, 2,000 tons of bitumen, 100,000 cu ft of timber, 20 tons of paint, 5,000 tons of coal, 60,000 tons of diesel oil and 100,000 tons of gasoline were used. Besides its military importance, the road will further the growth of trade between Kashmir and the rest of India.

FIRST MILITARY CONVOY crosses Madhopur Bridge on way to Jammu, Kashmir, following opening of new Pathankot-Jammu Road, vital link between Kashmir and India proper. In total length of 65 miles, road through frontier country includes 11 miles of bridges and culverts plus large number of causeways.

... THE READERS *Write*

Holds Many Reclamation Projects Not Justifiable

To the Editor: In discussing the article on the water plan of California, by Edward Hyatt, M. ASCE, in the October issue, Samuel B. Morris, M. ASCE, says in part:

"Arizona has introduced bills before Congress which would authorize the $738,000,000 Central Arizona Project to construct the Bridge Canyon Dam, divert 1,200,000 acre-ft of water per annum at Lake Havasu behind Parker Dam and, by a 1,000-ft pump lift and a 242-mile canal, convey it to some 226,000 acres of land in central Arizona which, it is claimed, would remain or revert to desert if this water is not secured. The irrigation capital cost of $1,600 per acre is to be entirely repaid by the power users, primarily in California. These lands when irrigated have a value of perhaps $300 per acre and cannot afford to pay more than operating costs."

The foregoing figures indicate the grandiose scale of reclamation and development projects when the national or state treasury is open to them. Reclamation at the cost given is unjustifiable, while America produces on other lands, at much lower unit costs, more than enough food for national needs. The public cannot afford to buy food at rates several times higher than it now pays.

In view of the rate at which enormous sums of money are being taken out of the national treasury and the state treasuries for multiple-purpose and other projects in the fields of industry and reclamation, the time is ripe for national and state commissions to dig down to bedrock and come up with the naked facts devoid of political or Utopian camouflage. As between governmental paternalism and private initiative and enterprise, the comparison should be on the basis of the facts, and nothing but the facts. Public treasuries should be open only to such projects as are justifiable and pressingly necessary and cannot be constructed by private enterprise. Paternalism should be held to a minimum.

America is a great and resourceful nation. She will grow and expand greatly even under heavy burdens. Nevertheless, her resources are not limitless. She should have her possibilities appraised accurately and find out where she is and the direction in which she is going. During recent years, she has swerved to ways of life that lead to totalitarian dictatorship. Let her remember that she has risen to her present position of world eminence in prosperity, well being and power in the American way—the way of freedom and private initiative and enterprise.

J. L. Campbell, M. ASCE
Glendale, Calif.

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Arizona's Position in Colorado River Controversy Summarized

To the Editor: In connection with the articles on the water plan of California, by Messrs. Hyatt and Morris, in the October issue, I should like to make a brief statement of Arizona's position on the Colorado River.

1. Arizona, under the eight documents or groups of documents that form "the law of the river," has firm rights to 2,800,000 acre-ft of Colorado River main-stream water, plus the use of the Gila River in Arizona's boundaries up to 1,000,000 acre-ft, in addition to half of the surplus to be divided in 1963. California is self-limited in perpetuity by its water-limitation act of 1929, passed to allow the state to take advantage of the Boulder Canyon Project Act, to 4,400,000 acre-ft of main-stream water, plus half of the surplus.

2. This water to which Arizona has firm rights is sufficient for all present and planned projects, including the Central Arizona Project.

3. California, on the other hand, not only is not using all her present allotment, but actually is wasting about 1,150,000 acre-ft (enough for the Central Arizona Project) into the Salton Sea each year, to establish a fictitious flow record for the All-American Canal so that water can be claimed for future, and speculative, development. We have photographs to prove the waste. Few Californians know that this wastage, which we consider one of the most criminal wastes of water in history, is occurring.

4. Los Angeles and the Metropolitan Water District have used only about as much water for the full period since construction of their aqueduct as they are entitled to for one single year under their primary right. We believe that, contrary to statements made for propaganda purposes, there is no shortage of water in Los Angeles or the Metropolitan Water District—nor should there be, in any foreseeable time in the future. We make that statement in view of the facts that the Metropolitan Water District is not using and has never used its full rights, and the Imperial Irrigation District is able to waste 1,150,000 acre-ft annually into the Salton Sea. We believe that a fictitious water use is being built up so that speculative development can occur on the East and West Mesas above the Imperial Valley. We feel that California wants Arizona's water for future speculative development; we know that Arizona wants her own water for use in rescuing lands under development at the present time.

5. For years, Arizona endeavored to negotiate, arbitrate and litigate—steps California now asks. Negotiation failed, because California was adamant. Once the four governors of the Upper Basin States served as an arbitration board, and California refused to accept the results, after submitting to the arbitration. California fought court settlement many years ago with the argument that Congress had, and should have, jurisdiction. On that basis, Arizona's water demands were squeezed down until they stood at the present level. Now California wants to throw the matter into litigation, knowing that this will take so many years that the water can be declared surplus and the state can then claim half or more of it.

Arizona wants the matter to rest with Congressional jurisdiction, and is asking Congress to authorize the self-liquidating Central Arizona Project, which is sound from both an economic and engineering point of view, in the form approved by the Bureau of the Budget, the Department of the Interior, and the Bureau of Reclamation. California's cry, "Let the Supreme Court decide," is simply propaganda intended to mislead persons not familiar with the history of the Colorado River controversy. The truth is the Supreme Court has already decided. California should amend her propaganda phrase to "Let the Supreme Court decide anew along California's line."

The Colorado River problem is not simple, and it is difficult to devise catch phases about it without ignoring the truth. Arizona's position, in brief, is that it has firm rights to water in the Colorado River, and that it now asks delivery of that water.

Howard J. Smith
Executive Secretary, Central Arizona Project Association
Phoenix, Ariz.

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Comments on Failure of Dues Amendment and Suggests Program for Future

To the Editor: "Did you vote on the dues amendments this year?"

That question has been asked of every ASCE member I've seen since the date ballot results were reported. The answers received may throw some light on the results.

One outstanding comment has been noted. When informed that Amendment No. 1 failed, a sizable percentage of members expressed surprise. A typical comment: "Why, I felt that it would definitely pass!" It appears that many members took for granted that it would pass

An analysis of the vote indicates that approximately 40 percent of the Society membership cast ballots (roughly, 9,600 out of 24,000). This is a drop from the vote last year of 46 percent. Of the nonvoting 60 percent of membership this year, should it be assumed that these members "took for granted" successful passage of the Amendment No. 1 and felt it unnecessary to vote? Quite likely not all of these members refrained for, that reason. It has been said repeatedly, and with some truth, that many of us who favor a question don't vote for it, but that those who oppose it definitely cast a ballot.

The 1947 vote was confined to corporate membership. The 1948 vote found nearly 8,000 Juniors qualified to vote. To date, I haven't found the percentage of Juniors who cast ballots any higher than that of corporate members. Many of the older members felt the Juniors would be anxious to vote after their enfranchisement. At least the "novelty" incentive would militate against any over-confidence on their part as to the result. After all, this was the first major question on which they were empowered to vote. Yet, it is apparent that the Juniors did not manifest any greater degree of interest in the balloting than we older members.

In 1947 the dues increase vote carried with it a dues equalization plan for District No. 1. Numerous arguments arose about the combination. Nevertheless, the vote failed by only 75 ballots. This year, the two ideas were separated, and Amendment No. 1 failed by 515 ballots.

A District breakdown of the 1948 vote indicates that District No 1 and also the members in foreign countries voted favorably on Amendment No. 1. Of special interest is the foreign countries' vote, wherein those affected voted to increase their dues. Some of these members are in countries where the amount of dues means a full wheelbarrow of paper money. Their loyalty and interest in Society welfare should shame us in the United States because the tangible values of Society membership are much less to them than to us.

The negative votes on Amendment No. 1 (3,722) constitute approximately $15^1/_2$ percent of the Society membership. Is it a healthy condition when $15^1/_2$ percent of the membership can cause the wheels of the Society to grind to a slower speed?

Some members volunteered the information that they voted negatively. When informed quietly and without argument, that it is hard to run any business today (in 1948) with the 1921 rate of income, most of the negative voters admitted they hadn't thought of it in that light.

We hear that the 1949 Society budget is to bring further cuts; that the budget for the field offices is to be halved; that technical publications will receive another cut, and that Section allotments will remain on the same reduced basis as in 1948.

It is believed that a sizable number of the Local Sections have operated "in the red" this year. This cannot continue for long Our Society budget needs to be restored at least to its 1947 basis, or even higher. How can it be done?

These suggestions come to mind; they are submitted in the spirit of sincere helpfulness:

1. The first subject on the agenda of the 1949 Local Section Conferences, "Shall the Society Maintain Its Forward Pace? How?" Delegates to these conferences should be instructed to "beat the grass roots" on the attitude of their members on the Society's program of the past five years.
2. An aggressive and dynamic membership campaign for new members should be instituted in 1949.
3. Every effort to complete, in 1949, the study on modernizing the Society's constitution should be made by the Board of Direction's special committee thereon.

Charles W. Yoder, Assoc. M ASCE
Milwaukee, Wis.

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Gives Additional Method of Deriving Cubic Equation

To the Editor: The derivation of the roots of a cubic equation, given by William R. Davis, M. ASCE, in the February 1948 issue, has elicited some interesting comments and solutions. As a further method, I submit the following.

Mr. Davis' method entails the use of a specially constructed chart to get the basis of his solution for the roots of the transformed equation. This in turn requires the application of these roots to arrive at the roots for the original or standard equation. It therefore depends on the accuracy with which the value is taken from the chart. If a chart is permissible, why not use standard cross-section, logarithmic or semi-log paper and plot two or three values for the negative root on each side of the zero line and join by a smooth or nearly straight line which would cross the zero line for the value of the negative root.

With a large scale, the result would be extremely accurate, and for use in actual practice two decimal points would be sufficient. By substituting the numerical value of n in the following equation, the author of which I do not know, the positive roots are at once available

$$x = -\frac{(A - n)}{2} \pm \frac{\sqrt{A^2 - 4B - 3n^2 + 2An}}{2}$$

The foregoing equation is derived as follows:

Let $x^3 + Ax^2 + Bx + C = 0$ be given

Let $n =$ the numerical value for the negative root

$$\frac{x^3 + Ax^2 + Bx + C}{x + n} = x^2 + (A - n) x + B - n(A - n)$$

, an exact quotient with zero remainder. This is a quadratic, with roots as given above. To check results, it is evident that $x_1 + x_2 = (n - A)$ or the sum of the negative values = the coefficient of A.

$\therefore (-x_1 - x_2 + n = A)\ n =$ (numerical value).

James B. Goodwin, M. ASCE
Toronto, Canada

SOCIETY NEWS

Merry Christmas and a Successful New Year

Voluntary Contributions

IN CONTINUING THE Voluntary Contributions Fund at its Fall Meeting, the ASCE Board of Direction expressed gratification to the more than 1,200 Society members who contributed during the first year of the Fund's existence. Special emphasis was placed on the fact that many of the contributors were older members whose financial obligations to the Society had been fulfilled when they attained the status of Life Members.

Since a good number of the suggestions for establishment of the Fund came from Life Members, a procedure was evolved for sending bill forms to them at the same time as bills are submitted to dues-paying members, so that an orderly method could be effectuated for remittance of contributions. The following letter accompanied the bill forms sent to Life Members, and is reproduced here as a matter of information to all members of the Society:

"TO EACH LIFE MEMBER OF THE
AMERICAN SOCIETY OF CIVIL ENGINEERS

"Dear Member:

"Despite your Life Membership in the ASCE, you are receiving a bill form from the Society just as you did before attaining the dues-exempt status to which Life Membership entitles you. Let me assure you, first of all, that there has been no change in that status, nor is there any intention to alter it.

"Forwarding of bill forms to the more than 2,000 Life Members at the same time as bills are mailed to the other members of the Society was decided upon by the Board of Direction as a means of calling the attention of Life Members to the Voluntary Contribution Fund established last year. As you probably know, withdrawals from this fund can be made only upon specific authorization of the Board for some special or urgent purpose.

"It is the hope of the Board that the Voluntary Fund will develop into a dependable cash cushion or reserve. In our present financial situation it is impossible to provide otherwise for such a reserve from current dues income. From the Voluntary Fund collected last year but $600 was expended. The balance remains as the beginnings of an emergency cash reserve, essential in the conduct of any business.

"Last year, over 1,200 members contributed to the Voluntary Fund. Many were Life Members who, although excused from further payment of dues, asked to be included, with the rest of our membership, in the creation of the Voluntary Fund. The bills of regular dues-paying members also will carry a Voluntary Fund item so that they, too, will be afforded opportunity to contribute.

"Again I want to emphasize that such contributions are purely voluntary on the part of members in *all* grades and to point out that the dispatching of a bill form to those members of our Society who have earned dues-exempt status, is merely an orderly method of offering the requested opportunity for voluntary contributions. Contributions to the Voluntary Fund are deductible in computing federal income tax.

"Please forgive the fact that, in the interest of economy, we have made this a circular letter.

"For the Board of Direction
American Society of Civil Engineers
"By William N. Carey, Executive Secretary"

Hoover Medal Awarded to Past-President Pirnie

MALCOLM PIRNIE, ASCE Past-President and consulting engineer of New York City, has been chosen as the tenth recipient of the Hoover Medal, in recognition of his work toward achieving recognition for the engineering profession in the solution of national and international problems. Presentation of the medal will be made to Mr. Pirnie at the Annual Meeting of the Society in New York City, on January 19, 1949.

Malcolm Pirnie

Instrumental in the formation of Engineers Joint Council, Mr. Pirnie served a term as chairman of the executive committee. He also played a prominent part in preparing the Engineers Joint Council reports on the industrial disarmament of Germany and Japan, which were put into effect in the postwar rehabilitation of those countries.

An alumnus of Harvard University, class of 1910, Mr. Pirnie was associated with Allen Hazen—in the firms of Hazen & Whipple; Hazen, Whipple & Fuller; and Hazen, Everett & Pirnie—from his graduation until 1929. Since the latter year he has headed his own consulting firm, which has built water supply and other projects throughout the United States and the Caribbean area. During the war, the firm concerned itself almost exclusively with Army and Navy work and defense projects.

Mr. Pirnie served the ASCE as Director from 1928 to 1930, as Vice-President in 1938 and 1939, and as President in 1944.

Established in 1929 in honor of Herbert Hoover, the medal is administered by the Hoover Medal Board of Award, consisting of representatives of the Four Founder Societies. The award is given for distinguished public service. Previous recipients include Herbert Hoover, Ambrose Swasey, John F. Stevens, and Gano Dunn all Honorary Members ASCE.

Professional Records of Nominees for ASCE Offices

HENRY J. SHERMAN

SENIOR PARTNER IN the Camden, N.J., engineering firm of Sherman & Sleeper, Henry J. Sherman is engaged in the design and construction of all kinds of municipal, industrial, river, and harbor improvements.

Following his graduation from Lehigh University, with the degree of C.E., Mr. Sherman served two years in the engineering department of the District of Columbia and four years in the Philadelphia Department of Public Works, under the late George S. Webster, ASCE Past-President. In 1900 he became a member of the firm of Haines & Sherman, of Camden, which was engaged chiefly in the design and construction of municipal improvements and in the location and construction of electric railways. On the death of the senior member in 1922, the present partnership was formed.

HENRY J. SHERMAN
Nominee for Vice-President, Zone II

In 1908 Mr. Sherman was selected by the late Governor Fort, of New Jersey, to become chief engineer of the newly created Department of Inland Waterways. In this capacity he supervised the construction of the New Jersey Inland Waterway from Cape May to Bay Head, a distance of 117 miles, and of its extension, the Bay Head—Manasquan Canal.

Mr. Sherman has served the State of New Jersey in many professional and public service capacities. In 1922, as a member of the Board of Engineers on the Erosion and Protection of New Jersey Beaches, he helped prepare a report that has since served as a model for the design of coast protection structures here and abroad. He has also served as consulting engineer for the Board of Commerce and Navigation of New Jersey on plans for coast protection; aided in the establishment of the South Jersey Port Commission to develop the New Jersey side of the Delaware; supervised the engineering work of the New Jersey–Delaware boundary dispute, which included valuation of $10,000,000 worth of waterfront structures in the contested area; and served as director and treasurer of the company building and operating the Tacony-Palmyra toll bridge over the Delaware River between North Philadelphia and Palmyra, N.J. He was a member of the Technical Advisory Committee, Comprehensive Plans Committee and Committee on Future Crossings of the Delaware River, in the preparation of the regional plan of the Philadelphia Tri-State District, completed in 1931.

In 1940 Mr. Sherman headed a group of engineers and architects, under the name of Sherman-Sleeper Associates, to design war projects. The organization served as architect-engineers for the enlargement of the Cape May Naval Air Base and the lighter-than-air-field at Lakehurst, N.J., and designed complete facilities for setting up the Wildwood, N.J., Naval Air Base to train dive bombers.

Becoming a full member of the ASCE in 1912, Mr. Sherman has been active in Society affairs for a number of years. He represented District 4 as Director from 1933 to 1935, and during his tenure was on the Committee on Publications, acting as chairman for a year. He was also on the Engineers Code Committee and other special committees. Mr. Sherman has been prominent in the Philadelphia Section, which he has served as director, vice-president, and president.

Active in forming and developing a New Jersey Society of Engineers, Mr. Sherman aided in merging the unincorporated society with an incorporated group, and later served as vice-president of the amalgamated society. His other affiliations include the Engineers' Club of Philadelphia, the Franklin Institute, and the American Shore and Beach Preservation Association.

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ROBERT B. BROOKS

PROMINENT AS A consultant in the transportation field, Robert B. Brooks has maintained an engineering practice in St. Louis, Mo., since May 1933. Mr. Brooks graduated from Washington University in 1910, with the degree of bachelor of science in civil engineering, and received the professional degree of C.E. from the university in 1922. Following his graduation, he worked in the engineering department of the St. Louis & San Francisco Railroad throughout the Southwest, and later went with the City of St. Louis as supervising engineer on sewer construction.

In 1914 Mr. Brooks joined E. G. Burkham and C. A. Moreno in partnership, forming the engineering construction firm of Moreno, Brooks & Burkham, which specialized in municipal and state highway construction in the Mississippi Valley states. After service in World War I as a commissioned officer in the Construction Division of the Army, he rejoined his firm.

As director of streets and sewers for the City of St. Louis from 1925 to 1933, Mr. Brooks initiated the collection of garbage by motor and substituted power flushing for sprinkling streets, saving the city $400,000 a year in special direct sprinkling tax. In his present consulting practice, which was organized in 1933, he specializes in a variety of transportation problems including highways, railways, pipelines, and waterways.

ROBERT B. BROOKS
Nominee for Vice-President, Zone III

Mr. Brooks has served the ASCE in many capacities. Elected an Associate Member in 1921 and Member in 1924, he was Director for District 14 from 1939 through 1941. Society committees, which he has served as chairman, include the Committee on Public Engineering Practice and Policy, the National Affairs Committee, and the Committee on Professional Objectives. He is also a former president of the St. Louis Section.

Long active in professional and civic affairs, Mr. Brooks represented the International Association of Public Works Officials at international sanitary engineering conferences held in Europe in 1931, 1935, 1938, and 1947. He was also a representative of the Secretary of State at the Eighth International Road Congress at the Hague, Holland, in 1938, and at the dedication of the Pan-American Highway in Mexico in 1936.

For eleven years Mr. Brooks was a

member of the City Plan Commission of St. Louis, and for five years a member of the Missouri State Highway Commission, and he is a past-president of the International Association of Public Works Officials. At present he is a member of the board of directors and chairman of the Highway-Railway Grade Crossing Committee of the American Road Builders Association; president of the Safety Council of Greater St. Louis; and member of the board of direction of the Municipal Theater Association of St. Louis. Mr. Brooks is also active in Washington University alumni affairs, being a member of the board of directors of the Alumni Association, and he was recently appointed a member of the Washington University Research Foundation Board.

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WALDO G. BOWMAN

As a member of *Engineering News-Record's* editorial staff for more than 20 years, and chief editor for the past eight, Waldo G. Bowman has had opportunity for a wide range of experience in the field of civil engineering and construction. Since 1940, he has also been editor of *Construction Methods*.

WALDO G. BOWMAN
Nominee for Director, District 1

A 1923 graduate of the University of Kansas, from which he holds a bachelor of science degree in civil engineering as well as a professional civil engineering degree, Mr. Bowman also studied at the Harvard Graduate School of Business Administration. For nearly two years following graduation he was a structural engineer with the Chicago Bridge and Iron Co., and then continued this same type of work with the Boston Bridge Works while attending Harvard.

During his many years in engineering journalism, Mr. Bowman has written extensively on nearly every phase of civil engineering work. Until he became chief editor he was the structural specialist on the *Engineering News-Record* staff. Just before and during World War II, his writings were focused on the monumental tasks and responsibilities that United States engineers and construction men had to assume. An early piece, "The Seabees Are Coming," outlining the training being given this newly formed construction and fighting contingent, was given special commendation by the Navy Department, which distributed a good many thousand reprints of the article in its recruiting drive.

During and after the war, Mr. Bowman made three extended trips abroad as a war correspondent for *Engineering News-Record*. In 1943, he reported on construction aspects of the landings on the continent and the Sicily invasion and the operation of the Trans-Iranian road to Russia. His second war assignment, starting in December 1944 and ending in April 1945, encompassed Great Britain, France, Belgium, Holland and Germany at the time when port, railroad and bridge construction was at its height. By chance, he was the only correspondent in the area when the Remagen Bridge collapsed, and he wrote and cabled the first and only detailed technical story of "What Happened at Remagen."

On his third visit abroad in 1947, Mr. Bowman traveled in Germany, at the invitation of the Secretary of War, to observe and report on the operations of our occupation forces. Subsequently, he spent a month in France and Switzerland to write about reconstruction progress and the needs upon which the Marshall Plan was then being predicated. In addition to a number of articles, two special reports resulted from this trip: "The Bridges of the Rhine—Their Destruction and Rebuilding," and "Reconstruction of the French Ports of Cherbourg, Le Havre and Marseilles."

Series of articles or special reports written by Mr. Bowman, which have been republished in booklet form, include "Civil Engineering in the Oil Fields" (1927); "Industry Builds Again—an Analysis of Roof, Wall, Floor and Framing Practices" (1937); "Building Bomber Bases in Britain" (1943); "U.S. Engineers in North Africa and the Middle East" (1943); "American Military Engineering in Europe" (1945); "Europe in Reconstruction" (1947); and "Puzzle in Panama—Fitting the Canal to an A-Bomb Age" (1947).

In the book field, Mr. Bowman is the author of the construction equipment section of Hool and Johnson's *Handbook of Building Construction* and the co-author, with other members of the editorial staffs of *Engineering News-Record* and *Construction Methods*, of *Bulldozers Come First*, an account of United States military construction from Tokyo to Berlin.

From 1928 to 1930, Mr. Bowman edited the *Proceedings* of the American Concrete Institute. In the early thirties, as a special aide to the chairman of the Construction Division, ASCE, he compiled and edited a series of manuals on the plant and equipment used in the construction of bridges, buildings, hydropower dams and flood control facilities. On three occasions he has served as member or chairman of the American Institute of Steel Construction jury of award for beautiful bridges.

Mr. Bowman is a director of the Metropolitan Section, ASCE, and was chairman of the program committee in 1944. He is also on the program group of the executive committee of the Construction Division, and has been a member of the Society's Annual Meeting committee on several occasions. His other affiliations include the American Concrete Institute and the American Society for Testing Materials. He is a licensed professional engineer in New York State, and a member of Tau Beta Pi.

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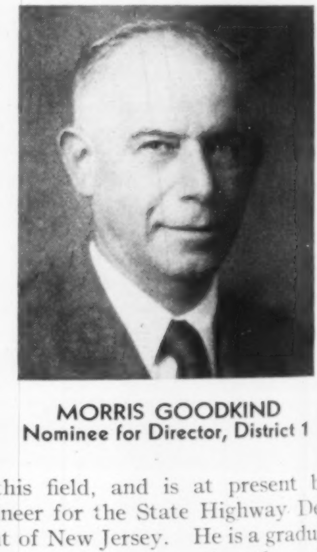
MORRIS GOODKIND

A specialist in the design and construction of bridges, Morris Goodkind has devoted his entire professional career to this field, and is at present bridge engineer for the State Highway Department of New Jersey. He is a graduate of Columbia University, where he received the degrees of A.B. in 1908, and C.E. in 1910, and won the Pulitzer and Faculty Scholarships.



MORRIS GOODKIND
Nominee for Director, District 1

Upon graduation, Mr. Goodkind was employed by the Public Service Commission of New York and the Department of Public Works of New York City for brief periods. From 1911 to 1913, he was associated with Albert Lucius, consulting engineer, as assistant engineer on the design and construction of railroad bridges, round houses and other structures for several railroads. From 1913 to 1918, Mr. Goodkind served as designer for the Interborough Rapid Transit System, New York, on the extension and third-tracking of the elevated railroad systems, and from the latter year to 1919 he was employed by the J. G. White Engineering Corp. on the design of the Muscle Shoals Nitrate Plant.

In 1919 Mr. Goodkind was appointed bridge engineer for Mercer County, New Jersey, where he was in charge of design and construction of county bridges until 1922. He then entered the service of the State Highway Commission as general supervisor of bridges in charge of the maintenance of all bridges in the State Highway System. Since 1925 he has been bridge engineer, supervising the design and construction of all bridges in the State Highway System, as well as those constructed with federal or state aid. During World War II he served as bridge consultant, Office Chief of Engineers, United States Army, on the development of military bridges.

Elected an Associate Member of ASCE in 1919, and Member in 1927, Mr. Goodkind is at present Contact Member for Rutgers University and vice-president of the Metropolitan Section. In 1930 he was awarded the Phoebe Hobson Fowler first prize by the ASCE for the design of the College Bridge in New Brunswick, N.J. Since then he has received eight awards for the design of beautiful bridges in the annual competitions sponsored by the American Institute of Steel Construction.

Mr. Goodkind has served as president of the Middlesex County Chapter of Professional Engineers, the Engineers Club of Trenton, and the New Jersey Association of Professional Engineers, and as vice-president of the National Society of Professional Engineers. During the past few years, he has been a member of the Engineering Advisory Councils of Princeton and Newark College of Engineering. He is also a member of the American Concrete Institute, American Society for Testing Materials and Tau Beta Pi.

His civic activities have included the chairmanship of building code committees of Trenton and New Brunswick, and he is at present a member of the City Planning Commission of New Brunswick and the Middlesex County Planning Board.

HAROLD L. BLAKESLEE

Harold L. Blakeslee has spent most of his career with the New Haven, Conn., construction firm of C. W. Blakeslee & Sons, Inc., which was founded by his grandfather in 1844. The firm has a wide reputation in the field of heavy construction.

Following Mr. Blakeslee's graduation from the Sheffield Scientific School of Yale University in 1907, with the degree of Ph.B., he was employed in the engineering department of the New York, New Haven & Hartford Railroad Co. for two years. He then began his association with the Blakeslee construction business, which he has served as contractor's engineer throughout his connection with the organization. He became assistant treasurer in 1929, when the partnership was changed to a corporation, and since 1934 he has also held the position of treasurer.

HAROLD L. BLAKESLEE
Nominee for Director, District 2

His work in the organization has included the supervision of bridges, bulkheads, dams, filtration and sewage disposal plants, foundations, tunnels, wharves, and a variety of general construction operations. These projects have been largely in southern New England, for cities, state highway departments, utility companies, the Army Corps of Engineers, the New York, New Haven & Hartford Railroad, industrial plants, and other agencies.

Entering the ASCE as a Junior in 1911, Mr. Blakeslee became an Associate Member in 1919 and full Member in 1948. He is a member of the Construction Division of the Society, and from 1933 to 1935 was chairman of the Division's Committee on Construction Plant and Methods. Long active in the Connecticut Section, Mr. Blakeslee served as president in 1937 and has been secretary-treasurer since 1943. Since the latter year he has also filled the position of Contact Member for the Yale University Student Chapter.

Mr. Blakeslee's other affiliations include the Connecticut Society of Civil Engineers, which he served as president in 1925, and the Yale Engineering Association.

PAUL L. HOLLAND

Well known in the field of public works engineering, Paul Holland has been Director of Public Works of the City of Baltimore since January 1948. Prior to that, he was for 17 years, chief engineer of the Public Service Commission of Maryland.

Mr. Holland's earlier career included 12 years of utility experience as superintendent of operations of the Georgia-Alabama Power Co., Albany, Ga., chief engineer and assistant manager of the Blue Ridge Power Co., operating in North and South Carolina; and staff engineer with Mees and Mees, Consulting Engineers, Charlotte, N.C., where he was engaged largely in utility design, construction, and operation. This work included a number of hydroelectric and steam-electric projects in North Carolina, South Carolina, and other Southern States.

A graduate of the U.S. Naval Academy in 1908, with the B.S. degree, Mr. Holland remained in the Naval service until December 1915, when he was retired for physical disability. Returning to active duty in March 1917, he served until December 1919, when he was returned to inactive status, with the rank of lieutenant-commander. During most of this tour of duty, he served as instructor at the U.S. Naval Academy, in the Department of Electrical Engineering, Physics, and Chemistry. He is co-author of *Modern Theory and Practice in Radio Communication*, a textbook used at the Naval Academy for a number of years.

PAUL L. HOLLAND
Nominee for Director, District 6

While with the Public Service Commission of Maryland, Mr. Holland did consulting work throughout the Southeastern States in connection with utility and industrial problems, specializing in rate cases and valuation work, depreciation and tax studies. As Director of Public Works of Baltimore, he is supervising the routine activities of the eleven bureaus comprising the department and is actively directing the largest program of highway, sewer, water supply, and public building improvements the city has ever undertaken.

A full member of the ASCE since 1941, Mr. Holland has been active in the Maryland Section and has served two terms as president. He is also a member of the Engineers Club of Baltimore, the Engineers Joint Council of Maryland, the Maryland Association of Engineers, and the American Water Works Association.

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EDMUND FRIEDMAN

A CONSULTING ENGINEER in general practice, Edmund Friedman is vice-president of the firm of Maurice H. Connell & Associates, Inc., of Miami, Fla.

Mr. Friedman, a native of Nashville, Tenn., graduated summa cum laude from Vanderbilt University in 1918, with the degree of bachelor of engineering. Shortly after graduation he enlisted in the Army for service in World War I. After his discharge from the Army he was engaged for several years in various phases of civil engineering, principally in private practice. In 1925, while assistant city engineer of Jackson, Miss., he accepted an appointment as city engineer of Coral Gables, Fla., serving in that capacity until 1929, when he became city manager of Coral Gables. His term of office was distinguished by an economical and efficient administration.

EDMUND FRIEDMAN
Nominee for Director, District 10

Appointed county engineer of Dade County, Florida, in 1932, Mr. Friedman soon developed an outstanding department and, at the same time, increased the scope of his work to include many activities not usually associated with such an office. As county engineer, he was largely responsible for the conception, planning, and development of the county's highway, zoning, and park systems, Rickenbacker Causeway, mosquito control, water control and conservation, and the planning of many other important county projects now nearing completion.

In 1942, Mr. Friedman was commissioned in the Engineer Corps of the Army, and served for three and a half years. During his army service, he participated in the construction of most of the military and air bases in Florida, and was also assigned for a year to the headquarters of the Army Service Forces. Placed on inactive status in December 1945, Mr. Friedman resumed engineering practice as vice-president of the firm of Maurice H. Connell & Associates. This firm, which was engaged in general engineering, was architect-engineer on government work totaling $50,000,000. Its recent assignments have included two veterans' hospitals, a $2,500,000 refuse incinerator for the City of Miami, and various utility improvements at Florida State College and Florida A. & M. College.

Since his election to ASCE membership in 1927, Mr. Friedman has been active in Society and Local Section affairs. He has served the Miami Section as secretary and twice as president.

Long interested in the social and economic advancement of the engineer, Mr. Friedman has also played a prominent part in the activities of other technical and professional groups. He has been president of the Florida Engineering Society; vice-president of the Southern District of the American Road Builders Association; secretary of the Florida chapter of the Institute of Traffic Engineers; and president of the Florida State Board of Engineering Examiners.

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S. T. HARDING

A SPECIALIST IN irrigation engineering, S. T. Harding has been engaged continuously in that field since 1907. Following his graduation in civil engineering from the University of Michigan in 1905, Mr. Harding spent two years in the Eastern states on work with the Great Lakes Survey at Niagara Falls and other projects. In 1907 he went west, where his first work was with the U.S. Reclamation Service (now the Bureau of Reclamation) on construction of the Yakima Project, particularly the Tieton unit. This was followed by various engagements in Utah and Colorado. From 1911 to 1914 Mr. Harding was in charge of the irrigation investigations of the U.S. Department of Agriculture in Montana. Other assignments during this period included investigations of water resources in California and Kansas.

In 1914, Mr. Harding became a member of the faculty of the University of California at Berkeley. He has continued in this position, giving courses in the Irrigation Division in irrigation practice, water rights and organizations. He is the author of texts on *Water Rights for Irrigation, Operation and Maintenance of Irrigation Systems,* and co-author with Prof. B. A. Etcheverry, M. ASCE, of *Irrigation Practice.*

SIDNEY T. HARDING
Nominee for Director, District 13

Since 1914 Professor Harding has also been engaged in consulting work, mainly in the fields of water supply, water requirements, and water rights. This practice has included work in nearly all of the Western states and for federal, state, and private agencies. Work for the federal government has included water right adjudications. Professor Harding had charge, for the State Engineer of California, of early water-supply studies in the San Joaquin Valley in the areas of overdraft of the local ground-water supplies. It is this overdraft that the Central Valley Project, now under construction, is designed to overcome. Professor Harding also handled the procedure of the state engineer in his administration of districts organized under the California water storage district act. For private interests, his work has included investigations and negotiations for several irrigation districts on proposed and operating projects of the U.S. Bureau of Reclamation, participation in litigation involving water rights, and settlements effected by negotiation without court trial.

Entering the ASCE as a Junior on his graduation in 1905, Professor Harding became an Associate Member in 1913 and Member in 1919. He has been a member of the Executive Committee of the Irrigation Division for two terms. Other Society activities have included membership on committees of the Irrigation Division and of the San Francisco Section. In 1947 he served as president of the San Francisco Section.

Discussers Can Help Increase Content of "Proceedings"

SHORTRIDGE HARDESTY, M. ASCE

Chairman Committee on Publications

FACED WITH THE problem of maintaining for our members a satisfactory content of the Society's PROCEEDINGS on a limited budget, the Publications Committee brings to the membership an appeal for cooperation in order that the Society may give to the profession the fullest service in terms of quantity as well as quality of its technical papers. In asking the assistance of our members, the Committee feels it is coming to the source for the help needed.

The wide discussion of PROCEEDINGS papers is the distinctive feature of the way the Society encourages and then distributes fundamental technical knowledge. No other publication of comparable coverage rivals PROCEEDINGS in this respect. In effect, the publication becomes a stage or a forum which affords full comment upon every subject. A new proposal then emerges confirmed or condemned, and the profession is the gainer, by an acknowledged acceptance or revision as may be called for.

Such a system can only be successful in so far as discussion is free and full. Hence the desire at all times for promoting wide comment and publication. This latitude, however, has its handicaps when considered in the light of the present budget. Every dollar spent for discussion means one less dollar spent for original papers. It therefore becomes important to economize on discussion whenever possible. The place where such condensation should logically begin is at the origin, namely, with the contributor himself. Worthwhile condensation by the Committee or the editorial staff can be effected only on an arbitrary basis or by time-consuming study, and even then the results are generally unsatisfactory to the discussers.

The plea of the Committee, then, is for a reasonable but strict standard of conciseness to be applied first and foremost by the discussers themselves. The editors will, of course, continue and intensify their alertness as to uniformity with the standard rules of discussion, which are given for convenience on the inside back cover of every PROCEEDINGS.

Ideas are not to be sacrificed, but they should be concentrated. This consists partly of eliminating surplus verbiage, whereby the discussion will be reduced to the meat of the argument with only enough explanatory matter to fulfill the needs of the reasonable reader, and partly of limiting discussion to important matters, omitting features of lesser importance.

The result, as the Committee sees it, will not necessarily be a reduction in the number of discussions. It should result in more pointed comments. The outcome should be a considerable reduction then in the volume of discussions, while at the same time the total amount of technical information in PROCEEDINGS, would be considerably increased because of the availability of space for more papers. This would serve the ideal of the greatest good to the greatest number.

The Publications Committee earnestly commends this ideal to the sympathetic consideration of every discusser in PROCEEDINGS.

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ASCE Committee Recommendation for Rating of Teachers Put Into Practice

SUCCESSFUL ADAPTATION OF the Society's recommended evaluation method for teaching positions to the rating of individual teachers has been reported by the School of Engineering at Fenn College, Cleveland, Ohio. The position evaluation plan was developed by the ASCE Committee on Salaries for use in its 1947 study of engineering teaching positions and salaries. Partial results of the study were reported in the September 1947 number of CIVIL ENGINEERING, and final results and recommendations in the February 1948 issue. Complete copies of the final report have been distributed to the deans of all engineering colleges granting degrees.

Dr. Sholto M. Spears, M. ASCE, dean of the Fenn College School of Engineering, became interested in the evaluation plan when it was described by the late Scott B. Lilly at the November 1947 meeting of the Engineering College Administrative Council of the American Society of Engineering Education. In search of a measuring device, other than scholastic productivity and research, to assist in making faculty promotions, Dean Spears enlisted the cooperation of engineering department heads, and a small committee was appointed to work out details.

The principal changes from the Society's suggestions were the elimination of scoring values for research, and formulation of a cumulative score basis for public relations and extracurricular activities. There was also inserted a 50-point item that can be awarded by the dean—the only place in the plan where intangibles have any effect on the rating.

Definitive point scores for the four academic ranks were ascertained by applying statistical methods to the score of the entire engineering faculty of 55 persons. The reason for eliminating scoring values for research at Fenn College is that research is not yet a strong factor in this exclusively undergraduate institution.

With the installation of the rating system, the Engineering School adopted a promotion policy, which utilizes the rating of the individual. This method has been found to be far more systematic and satisfactory than any other contemplated plan. One of the results of the faculty's acquaintance with the rating system has been a marked increase in faculty participation in the activities of the various engineering societies.

Copies of the complete report of the Society's 1947 Committee on Salaries, and a limited number of copies of Dean Spear's account of Fenn College's experience with the rating system, may be obtained upon request to the Executive Secretary, ASCE, 33 West 39th Street, New York 18, N.Y.

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United Engineering Trustees Elects Officers

EDWARD C. MEAGHER, treasurer of the Texas Gulf Sulphur Co., New York, was elected president of United Engineering Trustees, Inc., at its recent annual meeting in New York. The slate of officers also includes: James F. Fairman, vice-president of the Consolidated Edison Co., of New York, and ASCE Director Irving Huie, president of the New York Board of Water Supply, as vice-presidents; Kurt W. Jappe, treasurer of the ASME, as treasurer; James L. Head, Department of Mines, Chile Exploration Co., New York, as assistant treasurer; and John H. R. Arms, as secretary.

ASCE Executive Secretary William N. Carey will head the Real Estate Committee, which includes Warner Seely, secretary of the Warner & Swasey Co., Cleveland, Ohio (also elected to the UET board of directors), and Mr. Head and Mr. Fairman.

The chairman of the Finance Committee will be George W. Burpee, M. ASCE, consulting engineer of New York. Other members of the committee are R. F. Gagg, president of Air Associates, Inc., Teterboro, N.J.; D. A. Quarles, vice-president of the Bell Telephone Laboratories, Inc., New York; and Mr. Jappe and Mr. Head.

UET is a corporation set up jointly by the four Founder Societies to promote "the advancement of the engineering arts and sciences in all their branches, through two departments, the Engineering Foundation and the Engineering Societies Library." The corporation is the titular owner of the Engineering Societies Building and of the trust funds of the Library, the Foundation, the John Fritz Medal Board of Award, and the Daniel Guggenheim Medal Board of Award.

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Changes in Staff of "Civil Engineering" Are Announced

Walter E. Jessup, ASCE Western Representative, has been assigned to ASCE Headquarters as editor of Civil Engineering. He will replace Donald D. King, M. ASCE, editor for the past two years, who has resigned to enter business.

A member of the original Civil Engineering staff when the publication was initiated in 1930, Mr. King served 13 years as assistant editor in charge of art and production. Later he was with the Office of the Air Engineer, AAF, as editor of the Army publication, *Aviation Engineer Notes*, and assistant editor of *Construction Methods*, returning to Civil Engineering as editor in October 1946. During Mr. King's tenure as editor, the typography and format of Civil Engineering were changed and modernized.

In 1930 Mr. Jessup came to the Society as first editor of Civil Engineering, following some years of consulting practice in Southern California. He was transferred to the position of Field Secretary in 1935, and later was Washington Representative, and Acting Assistant Secretary. Beginning in July 1942, Mr. Jessup served in the Army Corps of Engineers—first as a training officer in the Engineer Replacement Center at Fort Belvoir, Va., and later in the Office of the Chief of Engineers, Washington, D.C., attaining the rank of lieutenant colonel. In the fall of 1945 he returned to the Society in charge of the Western headquarters in Los Angeles.

Robert K. Lockwood, Jun. ASCE, has been added to the staff as assistant editor. A graduate of City College of New York, class of January 1948, Mr. Lockwood has been a junior engineer with the New York consulting firm of Malcolm Pirnie and, more recently, with Robert Sawyer, Scarsdale, N.Y. During the war he served as staff plans and training officer in an Infantry Replacement Training Center, writing training curricula and laying out weekly schedules of classes. Later he was in Japan as staff war materials officer in charge of coordinating the activities of Battalion S-5's and keeping the regimental records. At CCNY, he was prominent in Student Chapter activities, serving as Chapter president and as chairman of the Metropolitan Conference of Student Chapters from May 1947 to January 1948.

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Joel D. Justin to Head Engineering Foundation

At its recent annual meeting, held in New York City, the Engineering Foundation elected ASCE Director Joel D. Justin, consulting engineer of Philadelphia, as chairman for the coming year. Dr. Boris A. Bakhmeteff, Honorary Member ASCE, consulting engineer and professor of civil engineering at Columbia University, was named vice-chairman. Reelected officers include Dr. Edwin H. Colpitts, director, and John H. R. Arms, secretary.

Joel D. Justin

Mr. Justin was also appointed chairman of the executive committee, and Mr. Arms will serve as secretary of that committee. Continuing their terms on the executive committee are Dr. O. E. Buckley, Dr. A. B. Kinzel, and R. H. Chambers, M. ASCE. Herman Weisberg, a mechanical engineer, is a new appointee to the committee.

Reports were made at the meeting on 18 research projects aided by the Engineering Foundation during the past year. These projects were concerned with studies in such varied fields as hydraulics, alloys of iron, properties of gases and gas mixtures, riveted and bolted structural joints, welding, and properties of metals at different temperatures. Grants were recommended for the continuation of nine of these projects, and for the support of five new ones, including the Council on Research in Reinforced Concrete.

The Research Procedure Committee will be headed by Dr. Bakhmeteff.

Veteran Wins Daniel W. Mead Student Prize

Frank J. Kersnar, Army veteran and newly elected ASCE Junior, will receive the 1948 award of the Daniel W. Mead Student Prize for the best paper on the selected subject, "Is it ethical for a professional engineer employer to utilize the services of a non-technically trained employee so that the latter is led to believe that, through training obtained in performing such services, he may attain a professional rating?"

Frank J. Kersnar

Mr. Kersnar studied at the University of Arizona, majoring in chemistry. He left in 1941 to become senior engineering aide in civil engineering for the U.S. Engineer Department on the construction of the Williams Air Base in Arizona. Later he entered the Army, serving as a bomb disposal and administrative officer in Africa, Sicily, Italy, and Corsica for three years.

Separated from the service as a captain in January 1946, Mr. Kersnar entered the University of California and obtained a B.S. degree in civil engineering with a sanitation option in June 1948. At present he is employed by the California Division of Fish and Game as a junior sanitary engineer in the field of pollution control.

Established in 1939 by the late Daniel W. Mead, Past-President and Honorary Member of the Society, the prize consists of a certificate and cash award of $25. Deferred during the war, award of the prize was reactivated by the ASCE Board of Direction at its 1946 Spring Meeting.

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New Officers for ECPD Are Elected at Detroit

James W. Parker, president of the Detroit Edison Co., was reelected chairman of the Engineers Council for Professional Development at its recent two-day meeting in Detroit. Other officers named were: H. S. Rogers, M. ASCE, president of Polytechnic Institute of Brooklyn, vice-chairman; S. L. Tyler, secretary of the American Institute of Chemical Engineers, secretary; and C. E. Davies, secretary of the American Society of Mechanical Engineers, assistant secretary.

EJC Reconstitutes Labor Legislation Panel

IN VIEW OF the well publicized determination of the incoming Democratic Administration to repeal the Taft-Hartley Act or to modify its provisions, Engineers Joint Council at its meeting on November 22 reconstituted its Labor Legislation Panel with the objective of working with the 81st Congress for retention of the present provisions affecting professional employees.

A similar panel sponsored by EJC presented the viewpoint of professional employees before committees of the 80th Congress and, as a result, the Taft-Hartley Act stipulates that the National Labor Relations Board cannot include professional employees in heterogeneous bargaining units against the wishes of a majority of those employees. Also, the Act defines "professional employees," for the first time in the national labor law's history, and guarantees any group of such employees the privilege of joining together for or refraining from collective bargaining if a majority so desires. Minority groups of engineering and other professional employees in industrial organizations thus find protection they did not enjoy under the Wagner Act.

Each of the five constituent societies of EJC is to appoint a representative on the Panel and, as before, the National Society of Professional Engineers and the American Society for Engineering Education will be invited to participate.

The Council took another step in internal organization by adopting a new constitution. The document already had been approved by the governing bodies of all constituent societies except AIEE. Certain proposed changes in the document were given favorable consideration by EJC in order to meet objections offered by AIEE. This should clear the way for unanimous approval in the near future.

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"Transactions," Volume 113, Ready for Distribution

FOR THE FIRST time in a number of years, the current volume of TRANSACTIONS, Volume 113, for 1948, is being printed, bound, and mailed during the year of record. Paper shortages and crowded printing schedules have delayed previous issues, with the result that two of these yearly volumes, 112 and 113, are being distributed during 1948.

As is customary, the subjects of structural engineering, hydraulics, and soil mechanics are generously represented in Volume 113. In addition, valuable studies are recorded in the fields of regional planning, highway design, airports and airfields, reservoirs, surveying, timber tests, irrigation, Mississippi River control—in fact, all the diverse problems that come before the modern civil engineer for solution. The Annual Address, delivered at Seattle, Wash., by President Dougherty, is printed in full, with its statement of the economic status of the Society.

About half the membership of the Society have standing orders for all volumes of TRANSACTIONS. A limited stock is also being set aside for those who now wish to add their names to the standing orders, or who prefer to buy single copies. The rates for the various bindings are: paper, $2.00; cloth, $3.00; and leather, $4.00 per volume. Although members of Student Chapters do not pay dues to the Society, they have been accorded special rates of $6.00, $7.00, and $8.00 for the paper, cloth, and leather bindings, respectively. Bindings in paper and cloth are expected to be in the mails during December 1948, but there may be some delay in the distribution of the leather volumes.

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Construction Courses Are Established in Colleges

OPTION PROGRAMS OF instruction in construction engineering are being established in a number of educational institutions, according to the current report of the Committee on Construction Engineering Education.

Colleges and universities, offering such programs as of October 1948, are the University of California, Columbia University, Massachusetts Institute of Technology, the University of Mississippi, Purdue University, Stanford University, Texas A & M College, the University of Alabama, North Carolina State College, the University of Illinois, the University of Michigan, Washington University (St. Louis), and the Georgia Institute of Technology.

Early in May of the current year the Committee on Construction Engineering Education sent letters to the heads of civil engineering departments in engineering colleges and to chapter secretaries and branch managers of the Associated General Contractors, urging active cooperation in placing engineering students on construction projects during their summer vacation periods. The committee will soon direct follow-up inquiries to these agencies for information on student employment during the past summer.

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

ANNUAL MEETING
New York, N.Y., January 19–21
(Board of Direction meets
January 17–18)

SPRING MEETING
Oklahoma City, Okla., April 20–23
(Board of Direction meets
April 18–19)

ANNUAL CONVENTION
Mexico City, Mexico, July 12–14
(Board of Direction meets
July 10–11)

Coming Events

Alabama—Annual two-day fall meeting in Birmingham, December 10 and 11.

Cleveland—Dinner at the Cleveland Engineering Society, Cleveland, December 17, at 6:30 p.m.; meeting at 8 p.m.

Colorado—Meeting at the Denver Athletic Club, Denver, December 15, at 6:30 p.m.

Los Angeles—Regular meeting at the Alexandria Hotel, January 12, at 6 p.m. Junior Forum at 5 p.m.

Maryland—Meeting at the Engineers Club, Baltimore, December 15, at 8 p.m. Preceded by cocktails at 6 p.m. and dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York City, December 15, at 8 p.m.

Mid-South—Annual meeting at the Marion Hotel, Little Rock, Ark., on December 10 and 11.

Northwestern—Annual meeting in the Coffman Memorial Union, University of Minnesota, December 6, at 6:30 p.m.

Philadelphia—Joint meeting with the American Society of Mechanical Engineers, at the Engineers Club, Philadelphia, December 14.

Pittsburgh—Dinner meeting in the Engineers Society of Western Pennsylvania dining room, Hotel William Penn, Pittsburgh, Pa., on December 14.

Sacramento—Regular meetings every Tuesday at the Elks Temple, Sacramento, at 12:30 p.m.

South Carolina—All-day annual meeting at the Hotel Columbia, Columbia, January 14.

Wisconsin—Annual dinner meeting on December 16, at 6:30 p.m. Director L. M. Gram will speak on Society activities. Joint meeting with the A.S.M.E. and the A.I.E.E. in the Public Service Building, Milwaukee, January 5, at 8 p.m. Speaker will be ASCE Past-President Malcolm Pirnie.

Recent Activities

CENTRAL ILLINOIS

ENGINEERING PROBLEMS INVOLVED in the construction of wartime air bases in India were described by Prof. F. A. Reickert, of the University of Illinois, at a recent dinner meeting. Professor Reickert served as Engineer Officer in charge of procurement, siting, layout, and construction for the U.S. Tenth Air Force in India during the war.

At a recent meeting of the Junior Branch of the Section, the following officers were elected: W. G. Murphy, president; H. O. Ireland, vice-president; and W. F. Lytle, secretary-treasurer. For the technical program of the occasion, John Ascherman spoke on his experiences with the Creole Petroleum Co. at Lake Maracaibo.

CINCINNATI

A MOTION TO establish a Section "Committee for Professional Cooperation in Public Affairs" was unanimously adopted at a recent meeting. The aim of the new committee will be to develop Local Section interest in community affairs and to acquaint public officials with the names of members qualified to serve on special committees and boards. In the feature talk of the technical program, Cincinnati's proposed Third Street distributor was discussed in its relationship to the master plan by S. A. McGavren, chief engineer in charge of city structures. Mr. McGavren also outlined the function of the distributor in the solution of Cincinnati's serious traffic problem.

COLORADO

SOCIETY POLICY WAS discussed in detail at a recent meeting, with ASCE Representative Walter E. Jessup present in the capacity of consultant and adviser. Mr. Jessup's suggestions for increasing the effectiveness of Local Sections included "boosting" the Juniors to as great an extent as possible and scheduling joint Section meetings on a regional basis. Such gatherings, he stated, would do much to foster ASCE relationships on a broader scale than is afforded by local meetings. There was considerable discussion of the report of the Section's Policy Committee.

ILLINOIS

STUDENTS FROM THE Navy Pier Branch of the University of Illinois, Northwestern Institute and Illinois Institute of Technology attended the Section's November 1 meeting at Navy Pier. Ralph Johanson, Section Junior, gave an illustrated talk on Alaska and the Alcan Highway. A symposium on "The Community Park and School of Tomorrow" comprised the technical program at another recent meeting. The speakers were Thomas J. Higgins, director of building surveys for the Chicago Board of Education, and Walter Roy, of the Chicago Park District.

INTERMOUNTAIN

PROBLEMS OF WATERSHED management were presented at a recent joint meeting with the Ogden Engineers' Club by Reed Bailey, director of the Intermountain Forest and Range Experiment Station of the U. S. Forest Service. Stressing the interrelationship of soil and vegetation and runoff, Mr. Bailey stated that such protective measures as terracing and reseeding have had beneficial effects in certain Utah areas previously subject to erosion. At another recent meeting, F. G. Hampton, construction engineer for the Salt Lake Pipeline Co., described his experiences constructing a 180-mile oil line between Rangely, Colo., and North Salt Lake. His talk was supplemented by remarks by Charles V. Baxter, who will be in charge of operating the line.

IOWA

THERE IS GREAT need for young engineers in railroading today, according to C. G. Grove, chief engineer of maintenance of way for the Pennsylvania Railroad, who addressed a joint session with the Iowa State College Student Chapter. Mr. Grove stressed the many opportunities existing in the field and outlined the Pennsylvania Railroad's training program for young engineers. The attendance of 160 included 109 students.

KANSAS CITY

JUNIORS OF THE Kansas City Section were in charge of the program for a recent Section meeting. Experiments in sewage treatment by means of rapid sand filtration being made at the Denver, Colo., improvement plant were described by Byron N. Souder, designer for the Kansas City firm of Black & Veatch, and discussed by the group. Showing of a Corps of Engineers technicolor film on Missouri River flood control concluded the program.

A paper on shear and moment distribution applied to single arch bents was given by C. K. Martin, senior engineer for the Burns & McDonnell Engineering Co., Kansas City, at a recent meeting of the Juniors of the Section. Mr. Martin stressed the application of the Hardy Cross method of moment distribution as applied to the gable-type bent for structural frames.

KANSAS

CITY PLANNING IN Topeka was discussed at a recent dinner meeting by Joseph Benson, secretary to the City Planning Commission and member of the Topeka firm of Benson & Spencer, landscape architects. Following his talk, there was an enthusiastic general discussion of planning problems in Manhattan and Lawrence as well as Topeka. The Committee on Juniors, with Prof. George W. Bradshaw as chairman, discussed the possibility of increasing Junior participation in Society and Section activities. Tentative plans are being made to have them provide the program for one meeting.

LEHIGH VALLEY

PRESENT-DAY PRACTICES in timber engineering, in comparison with older methods, were outlined at the Section's first fall meeting by R. H. Gloss, research engineer for the Timber Engineering Co., Washington, D.C. His talk covered basic methods of truss framing, commonly used types of timber trusses, mechanical fastenings, and glue laminated construction. Mr. Gloss also discussed a few aspects of research being conducted by the lumber industry.

LOUISIANA

COOPERATION BETWEEN THE various state and federal agencies in carrying out Louisiana's statewide drainage program was stressed by Col. J. Lester White, director of the Louisiana Department of Public Works, in the feature talk at a recent dinner meeting. Since its authorization in 1921, the state's drainage program has effected the reclamation of many swamp areas, Colonel White stated. In a general discussion following his talk, it was brought out that a million additional acres of land will be available for cultivation upon completion of the present program. During the evening, M. L. McAlpin, president of the Louisiana State University Student Chapter, outlined the Chapter's present program, and the Section's award of Junior membership in the Society was presented to James E. Allen, 1948 graduate of L.S.U., for his outstanding scholastic record.

LOS ANGELES

Engineering construction in Sweden was discussed at a recent dinner meeting by Agne J. Sanberg, formerly associated with his father, one of Sweden's leading engineers. Mr. Sanberg was introduced by H. A. Van Norman, Los Angeles engineer, who commented briefly on his own recent trip to Sweden. A review of the 1948 activities of the Section's Sanitary Group, presented by Ruskin T. Gardner, chairman, concluded the technical program.

The Junior Forum, meeting just before the regular Section meeting, heard A M Rawn, former ASCE Director, speak on the topic, "The First Ten Years Out of College." Mr. Rawn is chief engineer and general manager of the Los Angeles County Sanitation Districts.

MARYLAND

In a talk on design and construction of the New York International Airport, which comprised the technical program at a recent meeting, Frank Lilien traced the development of the airport from its beginning some seven years ago as a military field to its present use as a commercial international airport. Mr. Lilien, an associate of Carillo & Green, consultants to the Port of New York Authority on the design and construction of the project explained that some of the design plans have gone through 40 stages of revision to meet changing requirements. Presentation of a film on construction operations to date, including the placing of 65,000,000 cu yd of hydraulic fill to reclaim the 3,200 acres originally under water, supplemented his talk.

METROPOLITAN

Films showing the reconstruction of a number of French highway and railroad bridges, including the famed Chaumont Viaduct, were featured at the first meeting of the fall season. Col. Emerson C. Itschner, of the Army Corps of Engineers, commented on the films and described similar operations of the Army Engineer Troops under combat conditions. A talk on "Nuclear Energy as a Source of Industrial Power" was given at the November 17 meeting by B. R. Prentice, of the Nucleonics Department, General Electric Co.

Speakers at two recent meetings of the Junior Branch have been Dr. Daniel Camjo, until recently director of the Venezuela Institute of Sanitary Works in charge of purchasing engineering supplies and equipment, who discussed "Aspects of Operating a Purchasing Office for an Overseas Engineering Project"; and N. C. Russell, of the Weston Electric Co., who described extensive alteration work being carried out at the company's Kearny, N.J., plant, while production continues on a 24-hour basis. Dr. Camjo is now associated with the United Nations on a board that will study the natural resources of various countries.

MIAMI

The flood situation in South Florida during the past two years was summarized by D. B. Bogart, director of the U.S. Geological Survey in the Miami area, at the November 4 dinner meeting. Flood waters over the Everglades and low areas west of Miami reached record highs in this period, with consequent severe damage to homes, farms and other developments built during the preceding three-year period of drought, according to Mr. Bogart. In the general discussion following his talk, a motion was adopted to appoint a committee to study the subject of making suitable recommendations to the proper public bodies for the protection of innocent purchasers of property subject to flooding. The principal speaker at another recent meeting was Charles Leyden, editorial writer for the *Miami Daily News,* who discussed the rapid development of the Greater Miami area in the past few years and the resulting increase in engineering work. He stated that it is the duty of the profession, with its highly specialized skills, to aid the community and public officials on engineering matters.

MID-SOUTH

A panel discussion on "The Utilization of Engineering in Construction" launched the Section's recent three-day fall meeting, held at the University of Mississippi as part of the university's centennial celebration. The School of Engineering at the university has done pioneer work in establishing construction courses in its undergraduate curriculum, so the theme of discussion was considered particularly appropriate. The panel of speakers emphasized the fact that the construction industry is beginning to employ more and more engineering graduates for training as construction supervisors, and that "the era of the blustering supervisor with a minimum of formal education seems to be drawing to a close." The Friday evening banquet featured an address by Dwight W. Winkelman, president of the Associated General Contractors of America, who spoke on the relationship between civil engineering and contracting and the necessity for full cooperation between the two if a job is to be well done. The Saturday morning session scheduled papers by three Student Chapter members—E. C. Brown, of the University of Mississippi, D. M. Bader, of Mississippi State College, and A. B. Ryan, of Vanderbilt University. The latter described his own design for a precast concrete house, economical and simple enough for home construction. Special features of the meeting included an exhibit of heavy construction machinery on the campus. It was the consensus of the 200 in attendance that the meeting was one of the best in many years, and special thanks were given Dr. F. H. Kellogg, chairman of the civil engineering department at the university, for the success of the meeting.

NORTH CAROLINA

Aluminum as a structural material was the subject of a paper presented at the opening session of the Section's recent fall meeting, at North Carolina State College, by Paul Weidlinger, structural engineer for General Engineering Associates, Washington, D.C. Other speakers were H. B. Robinson, vice-president in charge of the operations and engineering departments of the Carolina Power & Light Co., who discussed "Interconnected Operations of Private Utility Systems," and G. W. Gillette, executive director of the North Carolina State Ports Authority, who outlined the work and plans of the Authority. During the afternoon session, papers were presented by Student Chapter Members L. C. Cheek, of Duke University, and Kenneth C. Coble, of North Carolina State College. A review of student activities—by E. L. Larner, president of the Duke Chapter, and S. N. Richardson, president of the North Carolina State Chapter—and inspection of the college engineering laboratories concluded the all-day program.

NORTHWESTERN

Three engineers discussed various aspects of the proposed Cedar-Franklin grade-separation project in Minneapolis at the November 1 meeting of the Section. These were Fred T. Paul, former city engineer, who described the historical background of the project; T. S. Thompson, engineer of urban plans and surveys of the Minnesota State Highway Department, who summarized the engineering details; and A. B. Chapman, assistant chief engineer of the Chicago, Milwaukee, St. Paul & Pacific Railway, who discussed the railroad construction program connected with the project. The speakers were introduced by City Engineer Hugo G. Erickson, who gave a brief over-all picture of the project.

OREGON

ASCE Vice-President John W. Cunningham attended a recent dinner meeting and reported on activities of the Board of Direction at its Boston Meeting. The speaker of the evening was Dr. John Swarthout, who touched on the political and economic problems facing the European nations in a talk entitled "The Dis-United States." A proposal to join other Local Sections in the Northwest in sponsoring regional conferences was unanimously carried by the Section.

ST. LOUIS

The recent international engineering congresses in Stockholm and Rotterdam were discussed by Col. Lawrence B. Feagin, head engineer of the St. Louis District of the Corps of Engineers, at a recent luncheon meeting of the Section. Colonel Feagin attended the conference as a representative of the Corps of Engineers.

SAN DIEGO

San Diego's water situation was discussed at a recent dinner meeting by G. E. Arnold, water commissioner for the city. Mr. Arnold stated that San Diego County has two possible sources of water for the future—more extensive development of its own watersheds and the Colorado River. To alleviate the water shortage in the Southwest, he said, it may soon be found economically feasible to reclaim sewage effluent for certain uses, such as orchard irrigation where no root crops are involved.

PHILADELPHIA

Postwar construction work in Europe was discussed at the November 9 meeting of the Section by two members of the ASCE Board of Direction. Director Joel D. Justin, American vice-president of the International Commission on large Dams, gave a report on the International Conferences on Large Dams and Soil Mechanics held last summer in Stockholm and Rotterdam. He was followed on the program by Vice-President Gail A. Hathaway, chairman of the United States Executive Committee on Large Dams, who discussed engineering projects he has visited in Western Germany, Italy, and France. Both speakers were official Society delegates to the international conferences.

SAN FRANCISCO

Engineering aspects of the Los Angeles smog problem was considered at a recent dinner meeting. The principal speaker on the subject was Dr. Paul L. Magill, of the Stanford Research Institute, who is directing engineering investigations toward combating the air-pollution problem in the Los Angeles area. The attendance of 135 included a number of students.

SEATTLE

Data on the large pumps required for the Grand Coulee Irrigation Project were given by Ernest E. Lindros, assistant chief engineer of the Byron Jackson Co., in a talk featuring a recent technical program. Mr. Lindros illustrated his talk with slides showing the model testing of methods and procedures that was required before the huge pumps could be designed or built.

SOUTH CAROLINA

The South Carolina Section reports a two-day joint meeting with the South Carolina Society of Engineers at Charleston, S.C. Inspection trips were made to the new Hanahan Pumping Station of the Charleston water supply and to the Charleston plant of the West Virginia Pulp and Paper Co.

SOUTHERN IDAHO

Construction highlights of the Naval Ordnance Gun Plant at Pocatello, Idaho, were explained at a recent meeting of the Section at Pocatello, by Roy S. Hunter, who served as an engineer on the construction of the plant. Walter E. Brown, retired Naval officer and a member of the Idaho State College faculty, then described the wartime operation of the plant. Preceding the dinner meeting, Section members were conduced about the plant and to points of engineering interest on the Idaho State College campus.

TACOMA

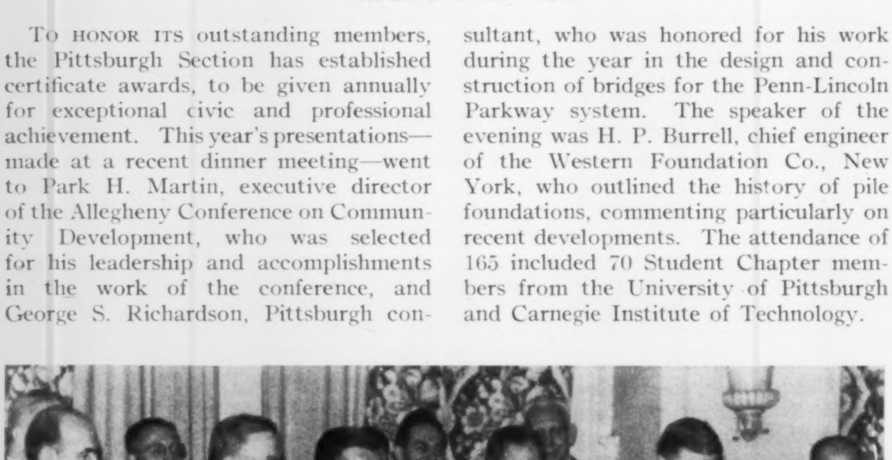
In a talk on "Use of the Lambert Grid in Land Surveying," which featured a recent meeting, Harold Walker, land surveyor of Olympia, Wash., showed the application of the grid to local land surveys, and emphasized the desirability of using it in public land surveys. Three Juniors of the Section—W. W. Bergerson, D. W. Trotland, and M. G. Walker—gave ten-minute discussions of state engineering programs.

TENNESSEE VALLEY

A first-hand account of the 1948 International Conference on High Dams, held in Stockholm during the past summer, was given at a recent dinner meeting of the Knoxville Sub-Section by Oren Reed, construction engineer for the Upper Holston Projects Branch of the Tennessee Valley Authority. Mr. Reed illustrated his talk with colored slides of

PITTSBURGH SECTION

To honor its outstanding members, the Pittsburgh Section has established certificate awards, to be given annually for exceptional civic and professional achievement. This year's presentations—made at a recent dinner meeting—went to Park H. Martin, executive director of the Allegheny Conference on Community Development, who was selected for his leadership and accomplishments in the work of the conference, and George S. Richardson, Pittsburgh consultant, who was honored for his work during the year in the design and construction of bridges for the Penn-Lincoln Parkway system. The speaker of the evening was H. P. Burrell, chief engineer of the Western Foundation Co., New York, who outlined the history of pile foundations, commenting particularly on recent developments. The attendance of 165 included 70 Student Chapter members from the University of Pittsburgh and Carnegie Institute of Technology.



HELPING THEMSELVES AT BUFFET SUPPER preceding meeting of Pittsburgh Section are (left to right) P. B. Ramsey, C. A. Keelen, vice-president of Section, E. O. Reed, G. A. Hinckley, A. J. Scuillo, R. O. Griffith, A. C. Ackenheil, G. S. Richardson, recipient of Section's engineering award, Section President G. G. Greulich, and G. P. Burrell, speaker of evening.

Swedish engineering projects made on his trip.

TEXAS

At a recent meeting of the Fort Worth Branch of the Texas Section B. A. Erickson, chief of flight tests for the Consolidated-Vultee Aircraft Corp., described the B-36 airplane, largest of the Army bombers, now in production at his company's Fort Worth plant, and commented on its great value as an offensive weapon in time of war. Mr. Erickson pointed out that the B-36 can carry 43 tons of bombs at a speed of 300 miles an hour for 6,000 miles. Other recent speakers include Texas State Senator Keith Kelly and Gordon Fisher, chief production engineer of the Gulf Oil Corp.

TOLEDO

Ways of improving the Toledo traffic situation were discussed at a recent meeting by Arnold V. Finch, city commissioner of engineering. Speaking on the subject, "Toledo's Major Thoroughfares," Mr. Finch described plans for improving and synchronizing the traffic signal system, installing traffic channels at busy intersections, widening principal streets where required, and better street lighting.

WISCONSIN

Financial, technical, and social problems involved in keeping Wisconsin lakes sufficiently free from pollution so that fish life can thrive were outlined at a recent meeting by Dr. William B. Sarles, professor of agricultural bacteriology at the University of Wisconsin and director of lake research for the university. ASCE Mid-West Representative George S. Salter addressed the gathering on the activities of the Board of Direction at its Boston Meeting, commenting particularly on the budgetary changes necessitated by defeat of the dues amendments. Members of the Wisconsin Section recently made an afternoon visit to the Petenwell Dam site, which was discussed at a dinner meeting that followed. Speakers were E. Montford Fucik, partner of the Harza Engineering Co., who described design features of the project, and Charles Wattles, resident engineer for the Harza Co., who commented on construction aspects.

STUDENT CHAPTER Notes

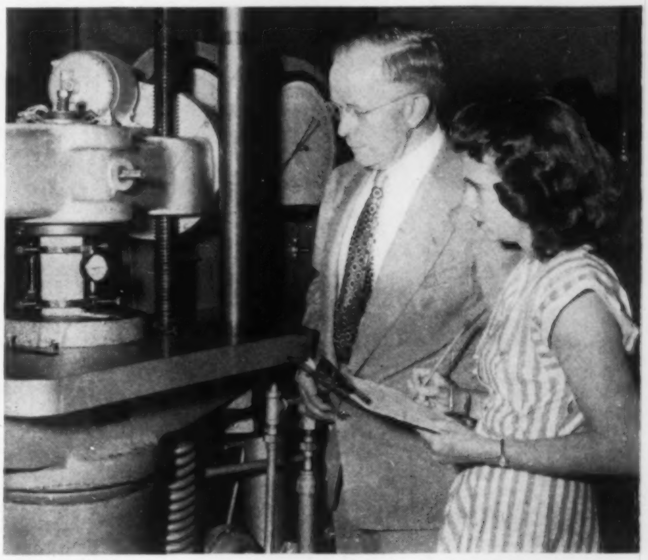
CASE INSTITUTE OF TECHNOLOGY

General plans and construction operations for the Mt. Morris Dam were presented at a recent Chapter meeting by B. R. Fuller, chief of the Buffalo District Office of the U. S. Engineer Department. Mr. Fuller, designer of the dam, illustrated his talk with slides that showed the urgent need for a dam to control the flood waters of the Genesee River and some of the construction difficulties encountered. The speech was of special interest to members of the Case Student Chapter because the research on the spillway retaining wall was conducted in the Warner Laboratory on the Institute's campus.

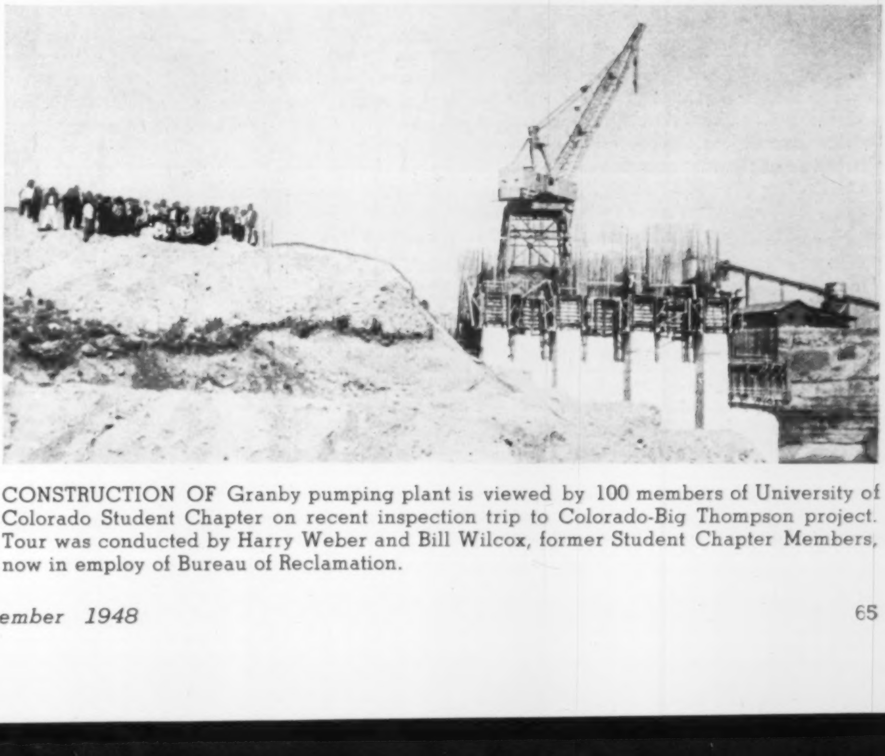
COLORADO A & M COLLEGE

The importance of research laboratories in the engineering field was emphasized by R. F. Blanks, materials and testing engineer for the Bureau of Reclamation, Denver, Colo., in a talk given before a large college group. To supplement Mr. Blanks' talk, members of the Chapter toured the laboratories of the Bureau of Reclamation. Another recent speaker was R. B. Ward, project engineer for the Bureau on the Horsetooth Reservoir. Mr. Ward described the progress on the nearly completed Colorado-Big Thompson reclamation project, of which the Horsetooth Reservoir is a part. The Chapter has a record enrollment of 100 members this year.

UNIVERSITY OF COLORADO



STUDENT CHAPTER MEMBER COLLEEN CONNELL takes readings in materials testing laboratory at University of Colorado College of Engineering, under supervision of Dean C. L. Eckel, M. ASCE. According to Dean Eckel, women engineering students generally maintain high scholastic averages. On list of 31 women engineering alumnae of university, who have graduated since 1903, are such well known engineers as Elsie Eaves, Assoc. M. ASCE.



CONSTRUCTION OF Granby pumping plant is viewed by 100 members of University of Colorado Student Chapter on recent inspection trip to Colorado-Big Thompson project. Tour was conducted by Harry Weber and Bill Wilcox, former Student Chapter Members, now in employ of Bureau of Reclamation.

NEWS BRIEFS

Continued Increases in New Construction Activity Are Reported

Construction activity continued at boom level in the third quarter of 1948, according to a recent Department of Commerce Industry Report. In terms of dollar value, a greater amount of new construction was put in place during this quarter than in any previous quarterly period on record. Compared with totals for the second quarter of 1948, gains for the third quarter were rather sharp, though much of this increase is attributable to seasonal factors. Coinciding with the quarter's increases in construction activity, advances were recorded in construction costs, in output and prices of construction materials, and in employment and earnings of construction labor.

Approximately $5.3 billion of new construction was put in place during the third quarter, an increase of 21 percent above the total for the second quarter and of 31 percent over that of the third quarter of 1947. New construction put in place during the first nine months of 1948 reached a total of $13 billion, some 34 percent above the total of $9.7 billion recorded for the same period of 1947.

Both privately and publicly financed new construction shared in the current nine-month increase to substantially the same extent. Privately financed construction, which has accounted for slightly more than three-quarters of all new construction activity thus far in 1948, reached a cumulative total of $10.1 billion up to the end of September—a 34 percent gain over the total for the first nine months of 1947. During the same period, publicly financed new construction activity advanced some 32 percent over its nine-month total in 1947 to reach $2.9 billion by the end of September of the current year.

The most important single factor contributing to the expansion of new privately financed construction has been a sharp rise in the volume of residential construction. By the end of September, new privately financed residential construction put in place during 1948 was valued at $5.1 billion—51 percent in advance of the nine-month total for the previous year. Of this dollar total, new residential construction accounted for more than half of all privately financed new construction put in place through the end of the third quarter of 1948, and for almost 40 percent of all new construction work. Industrial building is the only major category of new privately financed construction showing a decline in the dollar value of construction put in place for the first nine months of 1948, as compared with the equivalent period of 1947.

In the field of publicly financed construction, the outstanding feature of the first three quarters of 1948, compared with 1947, was a sharp rise in the volume of school building. The first nine months of this year saw new publicly financed school construction double in value over the equivalent period of 1947—$375 million through September 1948, as compared with $187 million for the same period of 1947. This expansion represents a response to the pressing need for new school and college buildings, resulting from the wartime lag in school construction, war and postwar population shifts, and federal assistance in veterans' education.

On a seasonally adjusted basis, new construction put in place rose steadily during the third quarter—from an annual rate of $17.7 billion in July to an annual rate of $18.8 billion recorded in September. Considered in conjunction with the volume of new construction put in place during the first half of the year, these seasonally adjusted rates appear to point to a 1948 construction volume approximating the total of $18 billion estimated in an earlier issue of the Construction Report.

Although the total dollar value anticipated for the entire year will sharply surpass previously recorded dollar-value peaks in construction, physical volume apparently will remain appreciably below the high points reached in 1942 and the mid-twenties. However, the physical volume of new construction during the first eight months of 1948, as measured by construction activity in 1939 prices, exceeded that of the equivalent period in 1947 by some 20 percent.

◆

Engineers Advise Businessmen at Meeting on Urban Problems

Engineers informed businessmen of ways and means of solving city traffic and zoning problems at the recent two-day Businessmen's Conference on Urban Problems in Detroit, Mich.

Calling upon business to "stop debating whose responsibility it is and actually assume the full responsibility for providing off-the-street parking spaces and truck-loading berths," Nathan Cherniack, M. ASCE, economist for the Port of New York Authority, asserted that, "Business would probably discover that, indirectly, it had created a new industry that would flourish for a good part of the second half of the twentieth century, namely, the rehabilitation and reconstruction of the cities of this nation to bring them physically into line with the transportation requirements of the motor and air age."

In a session on "City Streets and Modern Transportation," with Lloyd B. Reid, M. ASCE, Detroit consultant, presiding, speakers stressed the inability of traffic engineers and officials to cope with the traffic problem without the cooperation of businessmen. Another Society member participating in the conference was G. Donald Kennedy, vice-president of the Automotive Safety Foundation, who served on the program committee.

The conference was sponsored by two units of the Chamber of Commerce—the Construction and Civic Development Department and the Transportation and Communication Department—with the assistance of the Detroit Board of Commerce. There was an attendance of several hundred from all parts of the country.

◆

Moles Announce 1949 Construction Awards

Two well-known contractors—Luther S. Oakes, Assoc. M. ASCE, of Minneapolis, Minn., and Thomas A. Scott, of New York City—have been selected as recipients of the 1949 Moles Awards for "outstanding construction achievement." The awards will be presented at a dinner meeting of the Moles, New York society of tunnel and heavy construction men, to be held at the Waldorf-Astoria in New York on February 9, 1949.

Connected with Winston Brothers Co. since 1907, Mr. Oakes has been president of the organization for the past 27 years. The firm is a pioneer in railroad building in the Northwest. Captain Scott served as president of Merritt-Chapman & Scott Corp., of New York, for many years and is now chairman of the board.

◆

Steady Advance Is Noted in Cost of Construction

Construction costs continued to climb during July and August 1948, with average costs for August estimated at a point 117 percent above average construction costs during the prewar year of 1939, according to the Department of Commerce Composite Index. As of August, the latest month for which complete data are available, costs had gone up one-half of 1 percent from the previous month, some 8 percent since the beginning of the year, and 13 percent above construction costs in August 1947.

The rise of construction costs, as reflected by the Index, has been uninterrupted since the end of the war, except for one month in late 1945.

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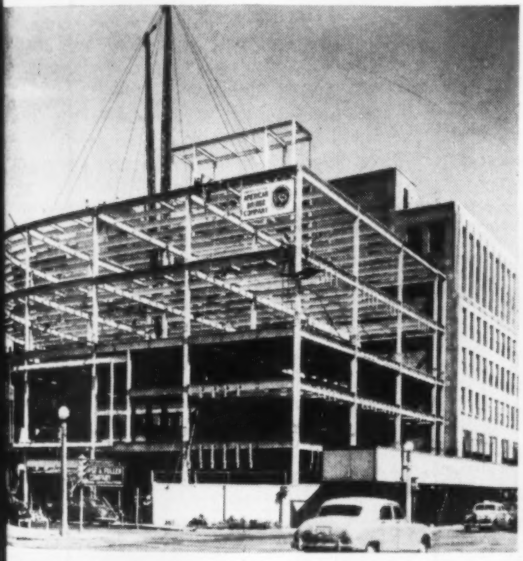
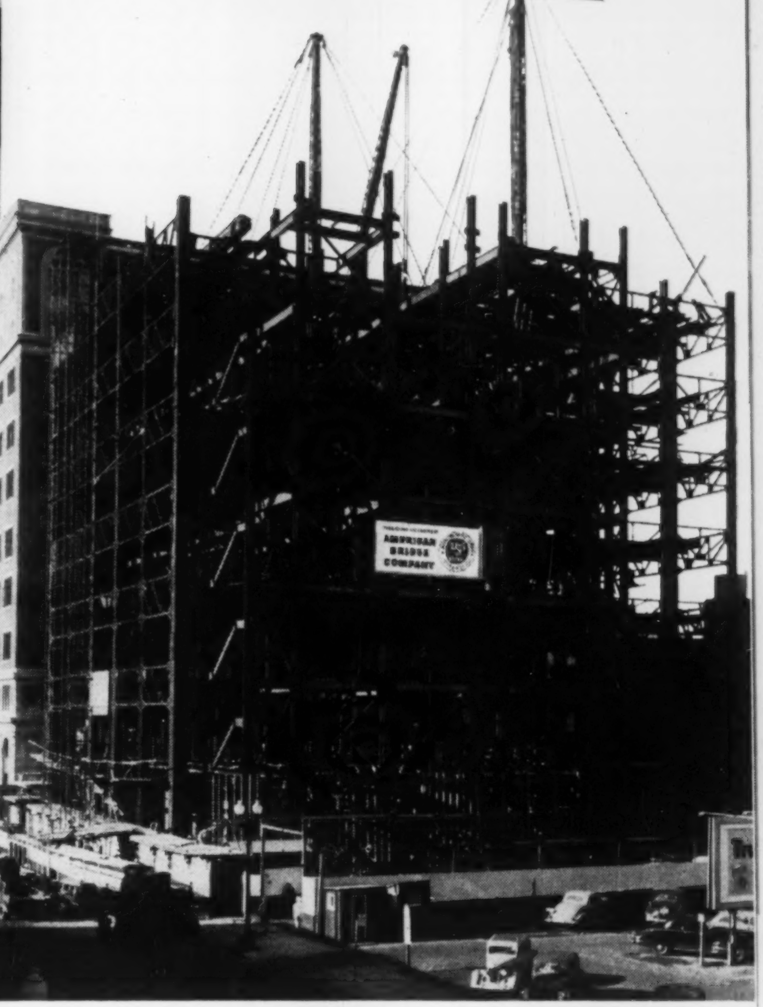


BONWIT-TELLER BUILDING, Chicago, Illinois. Fabricated and erected by American Bridge Company. George A. Fuller Company, General Contractors. Shaw, Metz and Dolio, Architects and Engineers.



EAST BAY FRANKLIN BUILDING, Oakland, California. This fifteen story building was fabricated and erected by American Bridge Company. Pacific Telephone and Telegraph Company, Owners. Harry A. Thomsen, Jr., Architect.

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VMI Host to Three-Day Virginia Highway Conference

Cooperation among state, county, and municipal officials as essential to successful highway planning and maintenance was stressed at the recent second annual Virginia Highway Conference, held at the Virginia Military Institute in Lexington. The three-day conference—sponsored by the Virginia State Highway Department and the Virginia Military Institute, with the Public Roads Administration and a number of Virginia organizations cooperating—attracted an attendance of 615 engineers, road-building contractors, and public officials from all over the country.

ASCE was well represented on the list of presiding officers and technical speakers, with Col. R. A. Marr, head of the civil engineering department at VMI, addressing the opening session on November 11; Hal H. Hale, executive secretary of the American Association of State Highway Officials, discussing "Highways at National, State, and Local Level" before a general session; and Frank Nikirk, mechanical engineer of Syracuse, N.Y., heading a panel discussion on "Machine vs. Manpower."

A summation of the achievements of the conference, given by Gen. J. A. Anderson, former ASCE Director and Virginia state highway commissioner, concluded the three-day technical program. Former Director N. W. Dougherty, dean of engineering at the University of Tennessee, was the principal speaker at the annual banquet. Urging greater professional pride in the highway engineering field, Dean Dougherty stated that it has a rich heritage. Early Roman roads, he said, "marked the historical beginning of our craft. When the Romans allowed their roads to go into bad repair a darkness spread over Europe."

Other Society members taking part in the program were Prof. K. B. Woods, director of the Joint Highway Research Project at Purdue University, who presided at a technical session, and Sterry Mahaffey, engineer-director of the Virginia Road Builders Association, who served as moderator of several panel discussions. A. C. Copland was also represented on the program in his capacity as president of the League of Virginia Counties, one of the cooperating organizations.

Showing of a three-dimensional motion picture on "Highways in the United States" and other films supplemented the technical program. Special features included exhibits of road-building equipment, a review by the VMI cadet corps, and a Saturday afternoon football game between VMI and The Citadel.

Holing-Through on Delaware Aqueduct Tunnel Celebrated

Another gap between New York's increasing water consumption and development of its Delaware River watershed source was closed on November 16, when city officials celebrated progress on the Delaware River water system in a "holing through" ceremony. The occasion was the blasting of the final rock section in the diversion tunnel, which will carry the waters of the East Branch of the Delaware River around the dam to be built near Downsville N.Y.

This 2,100-ft diversion tunnel, which has a finished diameter of 40 ft, will form a permanent part of the city's water system. When the Downsville Dam is completed, the upper end of the diversion tunnel will be plugged, and an inclined shaft will carry permanently the spillway overflow from the reservoir through the lower part of the tunnel to the river below. The tunnel is being constructed by the Walsh Construction Co. and B. Perini and Sons, Inc., who have, as a part of the same contract, the construction of a cofferdam and the concrete cutoff wall for the main dam. The amount of this contract is $13,700,000.

Downsville Dam, a rolled earthfill structure, will back the water of the East Branch 18-miles upstream to form the 150,000,000,000-gal (460,000 acre-ft) Pepacton Reservoir. This reservoir is the farthest from New York (120 miles) and the largest to be built so far on the Delaware Aqueduct system. From its storage, 335 mgd will be diverted through a 25-mile tunnel to be built to Rondout Reservoir, which is at the head of the presently constructed 85-mile tunnel to New York City's Hill View Reservoir just north of the city boundary. Pepacton Reservoir storage, also, will include provision for the release of sufficient compensating waters into the Delaware River during low-water stages to comply with a decree of the U.S. Supreme Court to maintain the river gage at Trenton, N.J., above a stated minimum.

Starting at Pepacton Reservoir, the city's supply system will run southeast through Rondout Reservoir (fed also through a 5-mile tunnel diverting the Neversink River) through the Rondout-West Branch Tunnel, the West Branch-Kensico Tunnel, and the Kensico-Hill View Tunnel, which terminates just north of Yonkers. From that point it will enter the city's Tunnel No. 2, which went into service in March 1936, and from there will flow into city mains. About 28 miles south of Rondout Creek, the water tunnel passes under the Hudson River, from the west bank to the east.

Presiding at the break-through ceremonies was ASCE Director Irving V. A. Huie, president of the New York Board of Water Supply. Mr. Huie stated that the entire Rondout-Delaware Project is scheduled for completion by 1955. Pointing out that it is now necessary to meet a present demand of 1,200,000,000 gpd, Mr. Huie said that present sources can be counted on for only 1,045,000,000 gpd. "Two dry summers in succession could cause a severe drought in the city," he warned.

Construction of the $350,000,000 system was begun in 1937.

BREAK THROUGH IS MADE on Downsville Dam diversion tunnel (photo, left), part of New York City's new $350,000,000 Delaware River water system. View at right shows city officials and guests at recent holing-through ceremonies.

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Federal Mobilization Urged to Handle Public Construction Emergencies

An over-all federal program of mobilization for dealing with public disasters is urged by Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator, in a recent issue of the *Military Engineer*, publication of the Society of American Military Engineers. General Fleming states that, under the recently authorized Disaster Surplus Property Program, help has already been given to 17 areas devasted by tornadoes, hurricanes, fire, or flood. This help has been provided by the Bureau of Community Facilities of the FWA, which has been called upon to supply a great variety of surplus war assets materials and construction equipment.

The recent Mississippi-Missouri flood, in which 500 bridges were lost in one Missouri county alone, is cited by General Fleming as a case in point. The FWA sent to the devastated area 25 H-10 railroad bridges and five Bailey bridges, in addition to delivering 272,000 fbm of bridge lumber and 576,000 fbm of lumber to use in constructing forms for repouring concrete bridge foundations.

To be fully effective, such aid should be linked with a national policy which would provide increased federal aid and coordination in carrying out a program of disaster relief, according to General Fleming. "The record of the past year underscores this need," he states. "In addition, it points up the contrast between emergency measures for relief and restoration and the work of permanent reconstruction. Frequently the damage to permanent installations called for extensive and rapid rebuilding of public facilities, which was quite beyond the financial and material resources of stricken localities. In such situations, state or federal assistance was urgently needed. The latter phase of the problem is receiving careful study by the Congress."

Without suggesting that the federal govenment undertake the complete task of replacing destroyed public facilities, General Fleming stresses the fact that emergency measures are needed. "For maximum value they should be properly timed, adequate in scope, and well coordinated. We all know the magnificent work done by the Corps of Engineers in flood fighting, rescue, and evacuation and in carrying out a comprehensive program for the control and improvement of the nation's river basins. And in recent years the Public Roads Administration has been authorized to cooperate with state highway departments in repairing disaster-damaged roads and bridges which were part of the federal-aid highway system.

"But the magnitude of public disasters seldom conforms to such legal niceties. We have become largely an urban people dependent upon closely linked public services and facilities; these 'natural catastrophes' often strike with the impact of an aerial bomb.

"The Disaster Surplus Property Program has helped many communities shake off the paralyzing effects of unforeseen calamity. But once our limited pool of war assets resources is exhausted, the nation may lack even this approach to an over-all program of mobilization for public disaster."

MAJ. GEN. A. C. McAULIFFE, Deputy Director for Research and Development, Logistics Division, G.S. (right), congratulates Col. John N. Andrews, of Washington, D. C., on being named commanding officer of newly organized 2901st Research and Development Training Group. This "R and D Group" is composed of about 125 reserve officers, research specialists in such fields as electronics, engineering, chemistry, ordnance, and medicine. It is one of several similar Army research and development groups, recently organized for specialized training of reserve officers dealing with research problems in their respective fields of activity (see page 66 of November issue of "Civil Engineering.")

One-Man Flood-Control Project

SMALL CRAWLER-TYPE TRACTOR IS KEY UNIT IN one-man war against destructive spring floods in Turtle Creek at Beloit, Wis. To cope with annual flood crest 4 or 5 ft over bridge shown in background, John Strasburg, Beloit businessman, moved 300,000 cu yd of creek sand and gravel by means of crane, bucket, and Allis-Chalmers HD-5 Tracto-Shovel, converting mile of narrow 12-ft stream into 120-ft-wide channel. Entire job, including riprapping of both banks, costs about $3,500.

Contract for Construction of Benbrook Dam Awarded

Construction of Benbrook Dam, on the Clear Fork of the Trinity River near Fort Worth, Tex., will be completed under a $4,263,000 contract awarded to the List & Clark Construction Co., according to a recent announcement from the Galveston District of the Corps of Engineers. Designed primarily for flood control and water conservation, the project will consist of a dam, 9,200 ft long with a maximum height of 130 ft. The reservoir will have a total storage capacity of 258,630 acre-ft and cover an area of 7,634 acres.

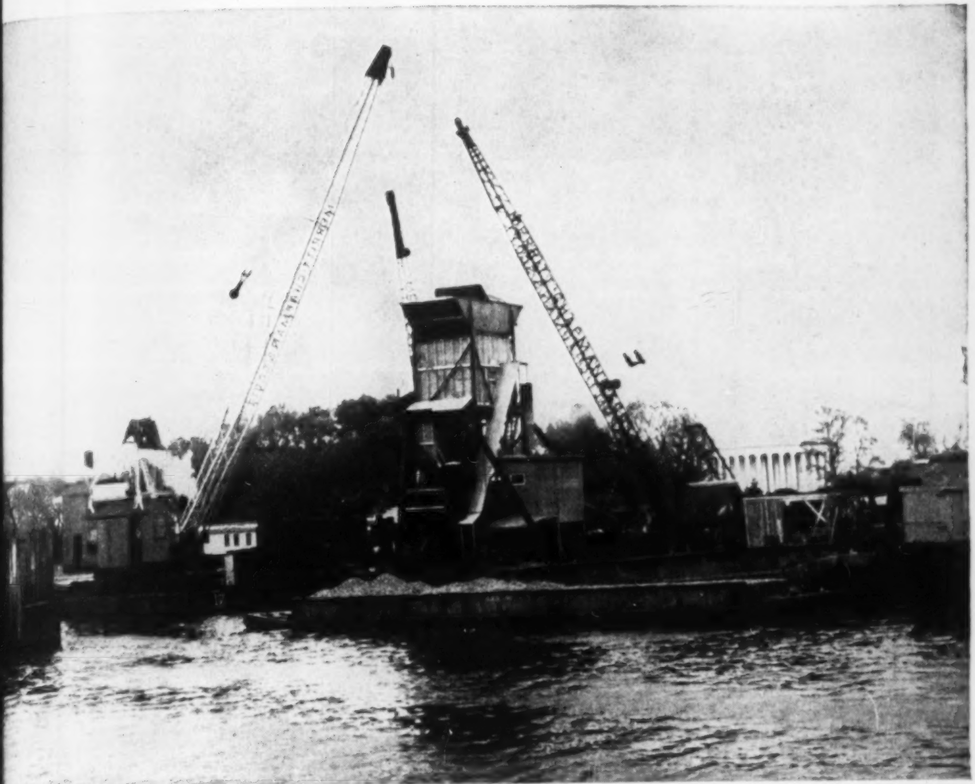
The project is one of four flood-control reservoirs to be built by the Corps of Engineers in the Trinity River basin. Completion date is set for 1951 at a total construction cost of $16,520,000.

◆

Site for Belton Dam Is Chosen by Engineer Corps

Selection of a site for Belton Dam—Army Corps of Engineers flood control and water conservation project—on the Leon River approximately four miles north of Belton, Tex., and seven miles north of Temple, has been made following detailed foundation studies conducted by the Corps. It is expected that construction of the dam, which will be approximately 1,900 ft long, with a maximum height of 200 ft, will begin early in 1949, and that about four years will be required for completion.

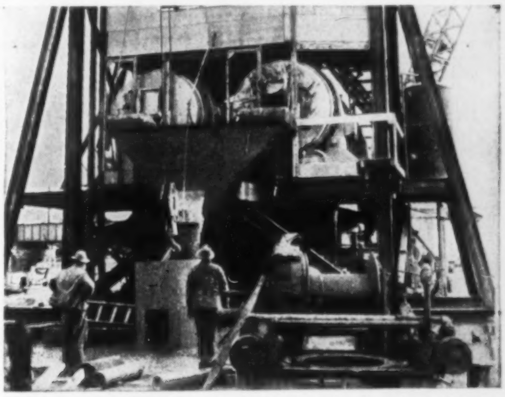
Helping to Throw a Bridge Across The Potomac



erritt-Chapman & Scott's "concrete fleet", showing the Blue Brute mixing plant and attendant barges.

rete for the piers of the new Washington-andria bridge over the Potomac is being d on a unique floating batching and mix-lant employing two Ransome Blue Brute Mixers. Merritt-Chapman & Scott, Corp. ractors, combined a mixing and batching with a floating crane to keep the plant the forms. Cement, sand, and aggregate pplied from barges hauled to the plant, mixed concrete is hoisted by floating to the forms.

h one of these Blue Brutes is equipped the new Ransome "power pack"—a small, act unit containing the discharge mecha-'s automatic hydraulic control, allowing man operation with a single handlever.



Aboard Merritt-Chapman & Scott's floating mixing plant on the Potomac. Mixers are Ransome Blue Brutes, Model 56S.

uts in a Good Dig For New Housing

's a new housing project in West Orange, Jersey, and the Commonwealth Water pany—already serving a population of 00 in three New Jersey counties—is lay-pe to supply its water needs.

complete the job in the fastest possible the contractor, W. G. Fritz Construction pany of West Orange, uses Worthington Brute construction equipment. The pho-phs show a Blue Brute Portable Air pressor supplying air for rock drilling.

Worthington Blue Brute Air Compressor supplying air for rock drilling.

NEWS

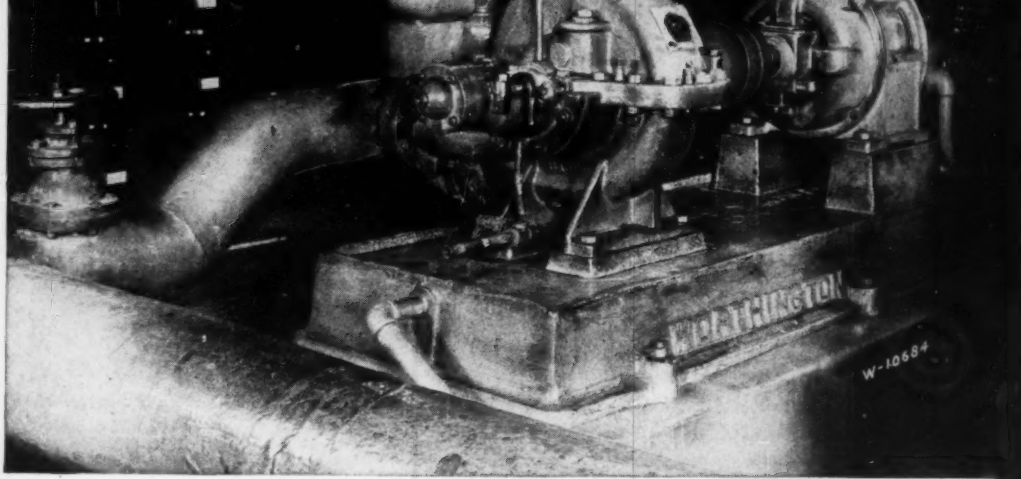
FROM THE PUBLIC WORKS FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

1

THINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

NEWS from the public works front



Worthington centrifugal pump handling entire water supply at Mutual Benefit Insurance Company, Newa

This Pump Turned Out To Be Good Insurance

21 years ago a 3-inch SD centrifugal pump was installed by Worthington at the home office of the Mutual Benefit Life Insurance Company, Newark, N. J.

Its job is to transfer city water from a reserve tank in the engine room to a penthouse tank, which supplies all the water needs—drinking fountains, washrooms, laundry, taurant—for approximately 1000 workers

Mr. J. Shearer, chief engineer, inform that in its 21 years in service, this Worth ton pump has never required repair, ex for repacking!

Largest Dual Fuel Engine Contract Awarded to Worthington

Power for operating the new $42,000,000 Hyperion-Activated Sludge Plant now being built for the City of Los Angeles, will be supplied by five SEHGO-8 1688 hp Worthington Dual Fuel Engines direct-connected to Electric Machinery Company generators. Four additional Worthington engines of the same size and type will supply power for operating four 40,000 cfm centrifugal compressors, throug step-up gears.

The compressed air is used for supplying air to the aeration tanks in the activated sludg process for biological treatment.

The contract for Worthington engine equip ment for this plant is the largest for this typ of service ever to be awarded in the world.

public works NEWS

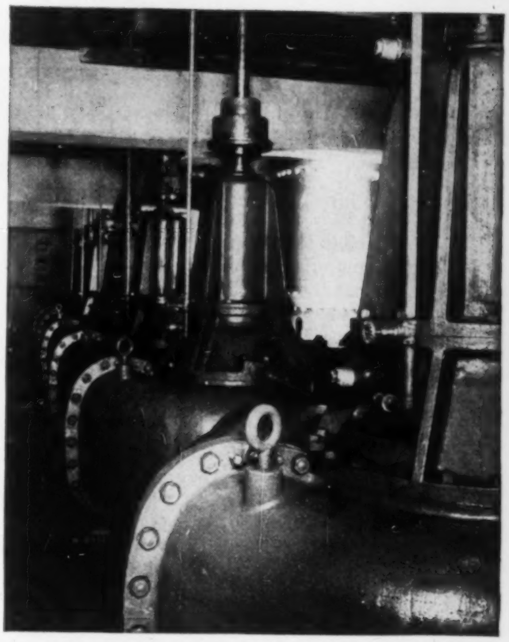
Worthington
Pump and
Machinery
Corporation
•
Harrison, N. J.

3

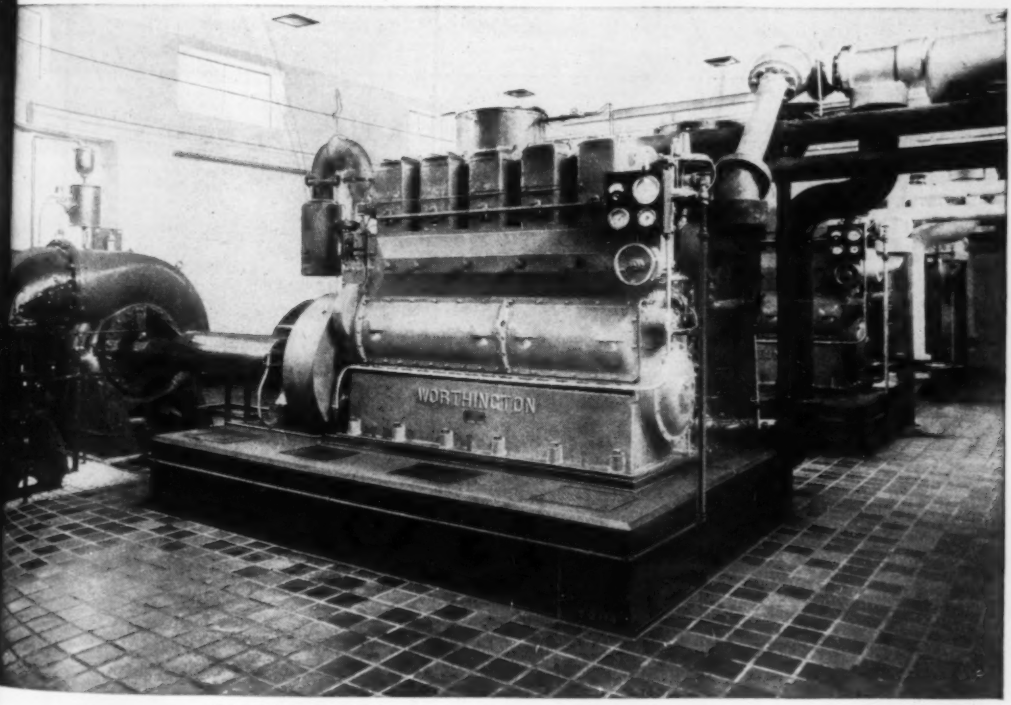
Kept Calm Through Years of Storms

en 30-MC-2 Worthington Vertical Volute flo Pumps used for pumping storm water the City of Rock Island (Ill.) Sewage Dis-al Works have been on the job for eight rs.

Mr. C. G. Durkee, chief operator, states: "It ght interest you to know that in the eight rs that these pumps have been in service re has never been one minute delay in their ration, and with the exception of repack- each pump once there has been no other intenance or repair other than lubrication."



Worthington Vertical Volute Mixflo Pumps in sewage plant at Rock Island, Ill.



Worthington 175 hp gas engines driving 20 mgd pumps.

Rosy Picture at Gary Sewage Plant

ecords of sewage treatment at Gary, Ind. for 947 show highly gratifying results—new cords for solids removal and second best arly showing in oxygen-demand reduction —while handling the fourth largest volume. Three 20 mgd Worthington pumps lift the sewage into grit chambers where it flows by gravity through the rest of the plant. The Worthington pumps are driven by 175 hp Worthington gas engines. Daily average was 19.9 mgd.

Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

SINCE THE END of the war the construction industry has built or rebuilt more than 100,000 miles of state highways, using revolutionary new improvements in paving techniques. Expenditures for highway construction during this period have totalled about $2.5 billion. Mechanization of road building has developed so far that there is only slight resemblance to the methods of a generation ago.

Today's traffic can be carried only because of wider pavements, more moderate grades, long-radius curves, and grade separations. Involving more grading and wider and heavier pavement, the modern highway could not be afforded on a wide scale except for time savings brought about in the construction operation.

Grading used to be so expensive, with old-fashioned methods, that the presence of a hill meant a steep grade up or a detour around. Now, however, we have tractor-drawn scrapers, power shovels, and draglines which have brought about a cumulative reduction of 75 percent in the cost of sand or dirt excavation.

By using rollers weighing up to 120 tons, heavy fills can be compacted so quickly that the paving can proceed without waiting several months for the earth to settle. The paving process for concrete, bituminous, and asphalt roads alike has also meant a consistent scrapping of old methods and equipment for new and better ones. The placing of a concrete pavement, for instance, has become a carefully planned and specialized, closely scheduled operation, with coordinated movement of men, machines, and materials.

The result is that a road-building crew can turn out a mile or more of a completed highway lane in a week. An indication of the efficiency of modern methods is that the cost of a composite mile of highway decreased more than 10 percent during the five years preceding the war, according to the index of the Federal Works Agency, while at the same time it was possible to increase average hourly earnings of highway workers by 18 percent.

◆

Virginia Highway Research Transferred to Virginia U.

TO FACILITATE ITS highway research program, the Virginia Department of Highways will transfer its research section from Richmond to the University of Virginia at Charlottesville early in 1949. The offices and laboratories of the highway department will be associated with the engineering department at the university to become the Virginia Council of Highway Investigation and Research.

The new council will be administered by a board composed of C. S. Mullen, chief engineer for the department of highways, as chairman; Edward W. Saunders, M. ASCE, dean of engineering at the university; and T. E. Shelburne, M. ASCE, director of research for the highway department. Although the council will be staffed primarily by employees of the highway department, faculty members and graduate and undergraduate engineering students may be given part-time employment on research projects.

Civil engineering students at the university will have an opportunity to obtain practical experience in studying problems of road building and upkeep, under staff members of the council who will serve as visiting members of the engineering faculty.

◆

University of Florida Sponsors Two-Day Surveying and Mapping Conference

TO PROMOTE THE coordination and exchange of mapping information between all mapping agencies and engineers in private practice in Florida, the University of Florida in cooperation with several state agencies recently held a two-day Surveying and Mapping Conference. Cooperating groups were the Florida State Road Department, state and federal mapping agencies, the Florida Section of the ASCE, the Florida Engineering Society, and the Florida Real Estate Commission.

Society members represented on the technical program included Robert M. Angas, Jacksonville consultant, who discussed the importance of having adequate surveying information; Comdr. Charles M. Thomas, U.S. Coast and Geodetic Survey, Atlanta, Ga., who described the present status of controlled surveys throughout the country in comparison with Florida; Russell H. DeGrove, civil engineer of Jacksonville, who spoke on the value of horizontal control for the registered surveyor and vertical control for the licensed engineer; and Prof. C. D. Williams, head of the civil engineering department at the University of Florida, who discussed the topic, "A Mapping Project for Florida."

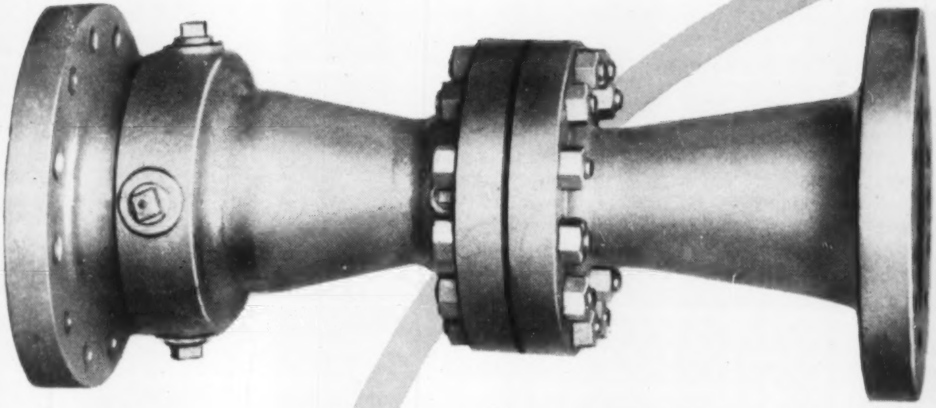
Prof. J. S. Dodds, head of the Iowa State College civil engineering department and member of the executive committee of the ASCE Surveying and Mapping Division, was the principal speaker at a banquet, social highlight of the conference.

At the conclusion of the conference, a resolution was adopted recommending development of a program for completing the topographic mapping of the state over a ten-year period. Establishment of a central state organization, to work with county engineers and surveyors in the collection and dissemination of maps and mapping information, was also recommended. A committee of seven engineers and surveyors was appointed to work out ways and means of accomplishing these objectives.

The attendance of 200 included civil engineers, surveyors, engineering students, and real estate representatives.

ASCE Members Identified with Highway Research Group

ADVISORY BOARD OF JOINT HIGHWAY RESEARCH PROJECT—cooperative research endeavor of State Highway Commission of Indiana and Purdue University—observes one hundredth meeting. Initiated in 1936, group now maintains full-time staff to organize and conduct research and makes available numerous assistantships to outstanding engineering graduates from universities throughout country. Shown, left to right, are: J. T. Hallett, M. ASCE, engineer of roads, Indiana State Highway Commission; Prof. K. B. Woods, M. ASCE, associate director, Joint Highway Research Project; J. R. Cooper, engineer o bridges, S.H.C.; P. D. Miesenhelder, M. ASCE, engineer of materials and tests, S.H.C.; N. F. Schafer and H. D. Hartman, S.H.C.; R. E. Fadum, Assoc. M. ASCE, professor of soil mechanics, Purdue University; C. E. Vogelgesang, M. ASCE, chief engineer, S.H.C., A. O. Hastings, superintendent of maintenance, S.H.C.; and ASCE Vice-President R. B. Wiley, head of Purdue School of Civil Engineering and Engineering Mechanics.



SIMPLEX

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Simplex Venturi Tubes provide stable and dependable coefficient data over wide velocity ranges. When used with almost frictionless Simplex Meters a remarkable tank to totalizer efficiency results. An added advantage is the low head loss occasioned by Venturi Tubes when compared with other forms of primary devices.

Simple in design, responsive to slightest differential pressure changes, Simplex Venturi Meters give trouble free operation with minimum maintenance costs.

Write for illustrated bulletins from the Simplex Valve & Meter Company, 6724Upland St., Philadelphia 42, Pa.

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Economic Mobilization for War Is Studied

Problems involved in the economic mobilization of the nation for war were studied in detail at a recent course of the Industrial College of the Armed Forces, held in St. Paul, Minn. More than 200 Reserve officers, engineers, industrialists, and business leaders attended the two-week course, which was conducted by six Army, Navy, and Air Force officers headed by Col. T. F. McCarthy. Of special interest to engineers and constructors were lectures on materials controls, plant security, wartime facilities, small plants, dispersion of industry, and construction of underground facilities.

Pointing out the fact that 75 percent of the cost of World War II went into the products of industry, the courses emphasized the necessity of industrial mobilization for emergency. Protection aspects of mobilization were also stressed, with the idea that metropolitan areas, at least, must be prepared for aerial attack.

Discussion of ways of facilitating industrial cooperation included suggestions for the establishment of clearing houses for contractors' equipment, in metropolitan areas, in case of aerial attack. Greater emphasis will also be placed on the use of small plants, in the belief that it will be easier for construction organizations to service their needs.

Index of Scholarship and Loan Funds Now Available

Information on scholarships, loan funds, and grants of some 130 colleges and universities, compiled by the Women's Committee of the Engineering Society of Cincinnati and announced in the July issue of Civil Engineering, has been made available in mimeographed form. Copies, priced at $3, may be obtained from the Engineering Society of Cincinnati, McMillan at Woodburn, Cincinnati 6, Ohio.

Mrs. Robert C. Vogt was chairman of the Women's Committee in charge of the compilation.

◆

American Engineers Are Awarded Contract in Iran

To facilitate its projected $650,000,000 development program, the government of Iran has signed a contract with Overseas Consultants, Inc., for a preliminary study of economic and social conditions in that country. The seven-year program will cover far-reaching developments and reforms in agriculture, industry, communications, public utilities, and other public facilities.

Formed in June 1947, at the request of the United States government, to make a comprehensive survey of Japanese industries, Overseas Consultants, Inc., consists of a group of eleven well-known engineering companies that acts in an advisory capacity on foreign projects. Clifford S. Strike, president of Overseas Consultants, heads an engineering group that has recently left for Iran on the first phases of the study. He will be assisted by George V. T. Burgess, Assoc. M. ASCE, treasurer of the group, Paul B. Coffman, and James M. Barker.

◆

Navy Tests Flexible-Type Pavement for Airstrips

A nation-wide survey of flexible-type pavement, used for runways and taxiways at Naval and Marine Corps air stations during the war, shows that it has increased in bearing capacity since it was built, according to the Navy Bureau of Yards and Docks. Recent Navy tests reveal that such pavement, varying from 6 to 12 in. in thickness, can sustain individual wheel loads of from 5,000 lb to 30 tons. Had conventional specifications been followed, a thickness of from 15 to 45 in. would have been required.

In an examination of soil conditions existing under used pavements, the subgrade moisture content was found to be much lower and the density, or weight per cubic foot, much higher than design criteria assume. It was also found that, where flexible pavement is used, an increase in the bearing capacity of the bituminous runways may be attributed to the fact that use increases compaction.

According to the Navy, these findings hold great significance for the future because of the increasing size and weight of airplanes.

◆

Large Western Project Is Announced by U.S.B.R.

Among forthcoming Western construction projects, listed by the Bureau of Reclamation in its *Advance Construction Bulletin* for November 1, under head of "Bid Calls Expected This Month," is the following:

CANAL

Central Valley Project, California

Location: Near Patterson, Calif.

Work: Construction of earthwork, concrete lining, and structure for about 15 miles of the Delta-Mendota Canal, 4,600 cfs capacity.

Excavation	5,000,000 cu yd
Concrete in lining	117,000 cu yd
Furnishing and placing reinforcing steel	1,950,000 lb
Furnishing and installing 15- to 30-in. precast concrete pipe	3,850 ft
Furnishing and erecting timber in structures	300 mbm
Time Allowed for Completion:	750 days

Barge-Laid Submarine Pipeline to Carry Gas Under Mississippi

HAZARDOUS JOB OF LAYING 14-IN. NATURAL GAS PIPELINE for Texas Gas Transmission Corp. nears completion across turbulent stretch of Mississippi between Greenville, Miss., and Lake Village, Ark. Crossing, consisting of welded steel pipeline with $^3/_4$-in. walls, is laid in form of downstream catenary to offset action of current, shifting sand, and debris. Photograph shows section of pipe, in place on elevated ramp on construction barge, being welded electrically to other sections already placed in river. Large fleet of tugs, barges, ramps, and floats required for operation do not appear in photo. Pipeline crossing was designed by H. L. Sowers, chief engineer, and Fred D. Stull, pipeline and corrosion engineer, of company's Southern Division. N. A. Saigh, Assoc. M. ASCE, San Antonio, Tex., was general contractor, and Leonard W. Campbell, pipeline superintendent, on work.

Engineering Facts about
Johns-Manville TRANSITE PRESSURE PIPE
The Inyokern Earthquake

This aerial view shows a portion of the Naval Ordnance Test Station at Inyokern, California.

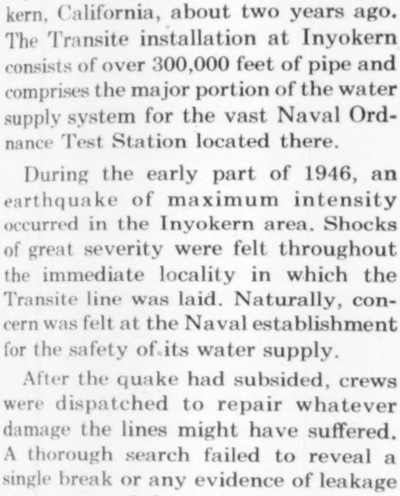
WATER LINES are seldom required to withstand a test as severe as that to which a Transite* asbestos-cement Pipe installation was subjected at Inyokern, California, about two years ago. The Transite installation at Inyokern consists of over 300,000 feet of pipe and comprises the major portion of the water supply system for the vast Naval Ordnance Test Station located there.

During the early part of 1946, an earthquake of maximum intensity occurred in the Inyokern area. Shocks of great severity were felt throughout the immediate locality in which the Transite line was laid. Naturally, concern was felt at the Naval establishment for the safety of its water supply.

After the quake had subsided, crews were dispatched to repair whatever damage the lines might have suffered. A thorough search failed to reveal a single break or any evidence of leakage at any one of the 25,000 joints in the system. Subsequent careful check of pressures and measurement of water levels confirmed that the lines had remained intact.

The reason this Transite installation was able to withstand this severe test is found in the inherent strength of the pipe and in the design of its Simplex Coupling, the standard coupling for Transite Pressure Pipe. Each of these couplings is a tight yet flexible link connecting one section of pipe to another and imparting to the line as a whole a degree of flexibility which enables it to "roll with the punch." Thus, shocks and vibrations are absorbed, stresses minimized to an unusual degree.

A factory-made joint which requires only assembly on the job, the Simplex Coupling derives its flexibility from its simple design. Consisting of a Transite sleeve and two rubber rings tightly compressed between pipe and sleeve, its simplicity and ease of assembly are apparent from the accompanying illustration. Moreover, this coupling is readily checked for proper assembly as the line is laid—further assurance of tightness in each individual joint and in the line as a whole.



This cutaway sketch shows construction of the Simplex Coupling used with Transite Pressure Pipe. It consists of Transite sleeve "A" and two rubber rings "B" which are tightly compressed between sleeve and pipe as the coupling is assembled.

Probably your water lines will never be called upon to absorb punishment as severe as the Transite lines at Inyokern. But the same engineering advances which protected this Transite installation can be depended on to safeguard equally well against the stresses normally encountered in water line service.

For further information about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE
JM
PRODUCTS

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*Transite is a registered Johns-Manville Trade Mark

N. G. NEARE'S Column

R. Robinson Rowe, M. ASCE

TRU·MAN = YYYYYY, wrote the Professor at the blackboard, followed by F·THOMAS = AAAAAA. So far it looked like cryptic comment on presidential inaugurals, but the plot changed suddenly.

AAA·BBCC = DDDDDD
OO·MOON = TTTTTT
INA·HIVE = BBBBBB
INA·POD = PPPPPP
ABBC·ACD = ACCD   ABC = EEEEEE

"Just literal arithmetic," explained Professor Neare. "In each exercise the object is to replace each different letter by a different digit to make the equation true. Years ago I was asked which digit was hardest to write and answered '4.' Ordered then to multiply 15,873 by 28, I bit on the gag and have been interested ever since in factors of numbers having the general form $1/9\,(10^n - 1)$. Can you do any four of the seven?

"Now, if Joe Kerr is ready, we'll learn who in the survey party got how many peanuts."

"Not from me you won't, Professor, and I'll tell you why not. If the party found N_0 peanuts and if at each division into s shares of n_1, n_2 . . . peanuts respectively r_1 r_2 . . . shares are returned to the new stockpiles of N_1, N_2 . . . peanuts, then the operations are alternately

$$N_0 - 1 = sn_1 \text{ and } r_1n_1 = N_1 \quad (1)$$

down to $N_4 - 1 = sn_5$ because $r_5 = 0$. By elimination,

$$r_1r_2r_3r_4n_1 - s^4n_5 = s^3 + s^2r_4 + sr_3r_4 + r_2r_3r_4 \quad (2)$$

and in this problem $s = 20$ and the r's are 19, 11, 17 and 13, so

$$46{,}189n_1 - 160{,}000n_5 = 20{,}051 \quad (3)$$

Remembering the peanut eaten by the chief, our other equation is $n_1 + n_5 = 2{,}143$, from which $n_1 = 1{,}662.989$. And that 0.989 peanut is 'why not'."

"Nice math for Joe," said Ken Bridgewater, "but the order of the r's wasn't specified. The 24 possible orders yield 24 equations like (3), differing only in the right-hand constant, which I called R. The general solution of this diophantine is $n_5 = 19{,}835R - 46{,}189k$ where k is any integer, and we have to keep looking until an R multiplied by 19,835 and divided by 46,189 gives a small remainder, n_5, less than half of 2,143."

"That's the sure, hard way," agreed Cal Klater, "but on the hunch that Noah wasn't that mean, I tried $r_4 = 19$ in Eq. (1):

$$19n_4 - 1 = 20(2143 - n_4)$$
$$n_4 = 42{,}861/39 = 1{,}099$$

That was encouraging, but when I found $N_3 = 1{,}099 \cdot 20 + 1 = 21{,}981 = 17 \cdot 3 \cdot 431$, I knew I was on the right track and that the head chainman was the third thief in the night. Then $N_2 = 3 \cdot 431 \cdot 20 + 1 = 25{,}861 = 11 \cdot 2{,}351$, and there was the transitman, who drew a total of $9(2{,}351 + 1{,}044) + 1 = 30{,}556$ peanuts, qed."

"Good hunching, Cal. Almost as good as the head chainman who was the first thief in the night and got 32,628 of the 72,341 peanuts with only seven shares—probably taking all the three-kerneled goobers. As a last generalization, look at Joe's Eq. (2) again; the extension for any number of r's is simple analogy."

[*The Cal Klaters were John L. Nagle and Richard Jenney and the Joe Kerrs were so close they'll be Klaters soon.*]

Meetings and Conferences

American Society of Mechanical Engineers. The 69th annual meeting of the American Society of Mechanical Engineers is being held in the Hotels Pennsylvania and New Yorker, New York City, November 28 through December 3. A program of technical sessions, luncheons sponsored by the various technical divisions, a Town Hall broadcast of the ASME program which will also be televised, and the annual dinner is planned for the five-day meeting.

International Heating and Ventilating Exposition. Headquarters for the International Heating and Ventilating Exposition will be the International Amphitheatre, Chicago, Ill., January 24–28.

National Research Council. The 28th annual meeting of the Highway Research Board of the Division of Engineering and Industrial Research of the National Research Council will take place in the building of the National Academy of Sciences and the National Research Council in Washington, D.C., December 7–10. During the week of the annual meeting the six departments of the Board—Economics, Finance and Administration; Design; Materials and Construction; Maintenance; Traffic and Operations; and Soils—will assemble to discuss research aspects of the important problems confronting the highway industry as a whole.

Society of Automotive Engineers. The annual meeting of the Society of Automotive Engineers will be held at the Book-Cadillac Hotel, Detroit, Mich., January 10–14.

National Warm Air Heating and Air Conditioning Association. The 35th annual convention of the National Warm Air Heating and Air Conditioning Association is scheduled for the Hotel Cleveland, Cleveland, Ohio, December 9–10.

NEW IN Education

ONE IN EVERY four veterans of World War II taking correspondence courses under the G.I. Bill is enrolled in a course in construction or a related field, a Veterans Administration sampling discloses. The 54,730 former servicemen enrolled in construction courses include 36,343 studying engineering.

* * *

A CURRENT ENROLLMENT of 401 students in the new school of Enginering at the University of Massachusetts, has been announced by Dean George A. Marston, Assoc. M. ASCE. Included in this number are 75 civil enginneering students, and 54 freshmen whose major in engineering will not be determined until the end of the current year. Two engineering buildings are now under construction, and funds for a third have been appropriated by the state.

* * *

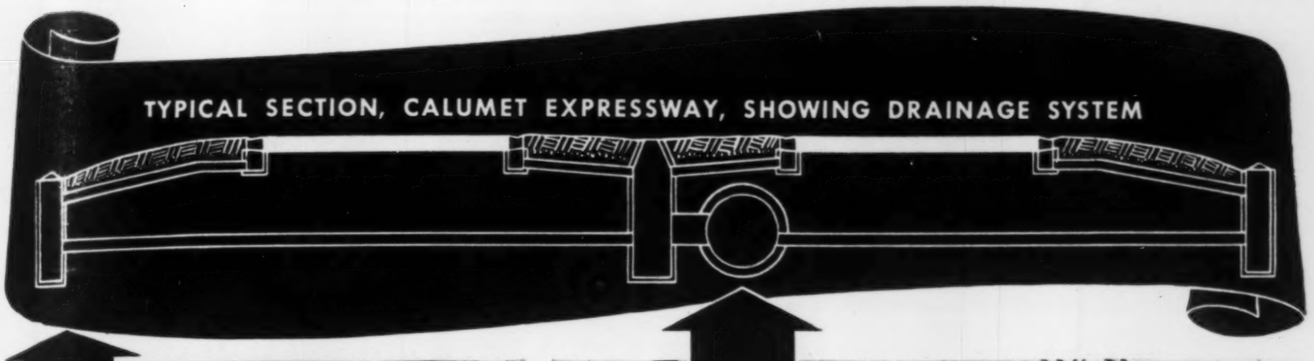
THE EXTENSION DIVISION of the University of Wisconsin announces revision of two of its courses in concrete construction to conform with the 1947 Building Code of the American Concrete Institute. The subjects are "Principles of Reinforced Concrete" and "Reinforced Concrete Fundamentals." These and other technical courses taught by correspondence are available from the Extension Division of the university.

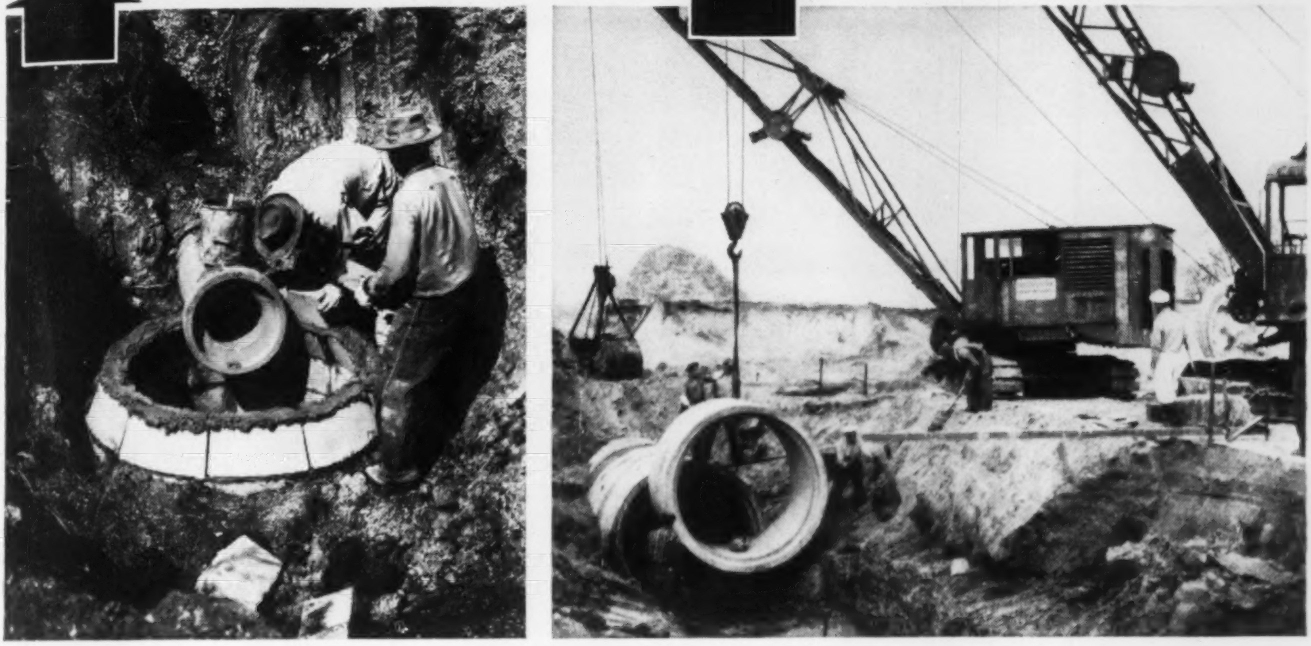
* * *

APPROXIMATELY ONE-THIRD of the senior class in civil engineering at Washington University, St. Louis, is enrolled in a new optional course in construction engineering, designed to train executives for the construction industry, according to Chancellor Arthur H. Compton. Stating that the new course is proving very popular, Chancellor Compton pointed out that the large volume of construction in the St. Louis area will provide laboratory facilities to supplement formal instruction.

* * *

A $20,000,000 PROGRAM "to keep the Massachusetts Institute of Technology in the forefront of scientific education" was recently approved by the Committee on Financing Development. About half of the amount required will be assigned as endowment and unrestricted funds, and the balance will go for new buildings and equipment to increase the Institute's technological facilities. Laboratory buildings for nuclear science, engineering, metals processing, hydrodynamics, and electronics are planned. The development program is based on a normal postwar enrollment at the Institute of some 4,500 students.


TYPICAL SECTION, CALUMET EXPRESSWAY, SHOWING DRAINAGE SYSTEM



Storm Drains for Modern Expressways are Built of *CONCRETE PIPE*

THE CALUMET Expressway, a new highway entering Chicago from the south, will be drained by modern, economical concrete pipe. The drawing above shows a typical section.

The expressway has two 24-ft. concrete pavements in each direction. They are separated by a median strip ranging from 18 to 36 ft. wide.

In the drainage system water is collected at the pavement edges and channeled to catch basins located off both shoulders and under the median strip. From them the water is delivered to a single large-diameter concrete pipe located near the centerline of the expressway.

Concrete pipe has been used for storm drains and storm sewers for more than a century. That experience has demonstrated that concrete pipe is moderate in first cost, has long life and costs little or nothing to maintain. These factors add up to ***low-annual-cost*** drainage.

Moreover, concrete pipe is outstanding for its structural strength and its ability to sustain heavy overburdens. Because it has a smooth interior finish, it not only resists abrasion but also provides maximum hydraulic capacity.

When planning a storm drainage system—or a water line, sanitary sewer or culvert—specify concrete pipe for modern, efficient and dependable ***low-annual-cost*** service.

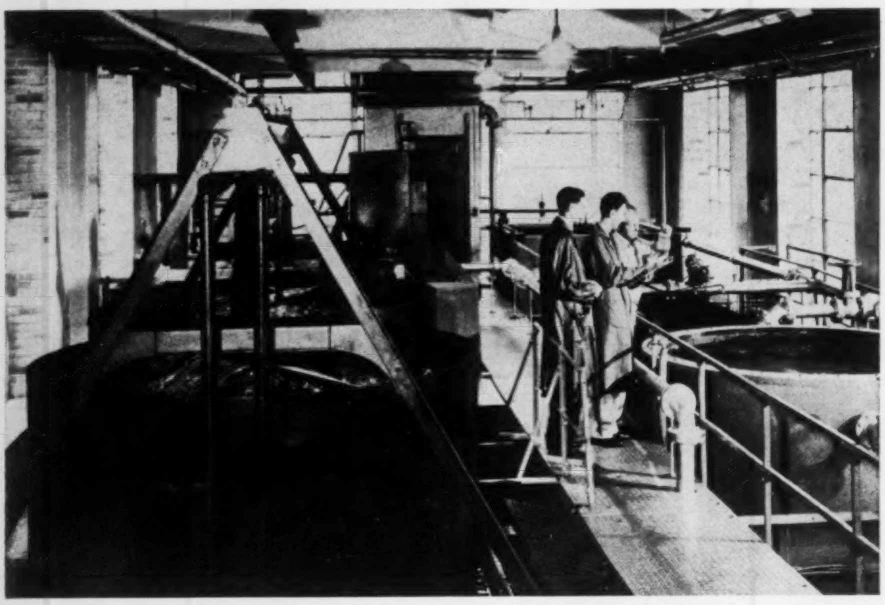
Photos show installation of concrete catch basin and 84-in. concrete pipe on the Calumet Expressway. The concrete pipe in this project ranges from 12 in. to 96 in. in diameter.

PORTLAND CEMENT ASSOCIATION

33 W. GRAND AVENUE • CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

Municipal Problems Studied in New York University Laboratory



RESEARCH FACILITIES OF SANITARY ENGINEERING LABORATORY at New York University College of Engineering include modern pilot plant large enough for community of 150 people. Here students examine effluent taken from large settling tank containing New York City sewage. Chlorine-treatment facilities are housed in adjacent room.

New Publications

Dam Reconstruction. Copies of a paper on "Rehabilitation of Barker Dam"—presented before the ASCE Power Division at the 1948 Annual Meeting and abstracted in the February 1948 issue of CIVIL ENGINEERING—have been made available for free distribution in limited supply by the authors, Raymond E. Davis and E. Clinton Jansen, Members ASCE, and W. T. Neelands. Requests should be addressed to Professor Davis at the Engineering Materials Laboratory, University of California, Berkeley 4, Calif.

Welding. A 58-page illustrated manual, containing complete engineering data on the Saxe System of welded connection units for the erection of welded steel structures, is now being offered by J. H. Williams & Co., 400 Vulcan Street, Buffalo 7, N. Y. The author is Van Rensselaer P. Saxe, M. ASCE.

Highway Finance. Five papers on different aspects of highway finance and administration—presented at the 27th annual meeting of the Highway Research Board in December 1947—have been issued as Bulletin No. 12 of the Board. Inquiries should be addressed to the Board, Washington 25, D.C.

Town Planning. A comprehensive plan for the reconstruction of Bar Harbor, Me., which was severely damaged by forest fire in the fall of 1947, has been prepared by the St. Louis, Mo., city planning firm of Harland Bartholomew, M. ASCE. Inquiries concerning the plan should be directed to Harland Bartholomew and Associates, 317 North Eleventh Street., St. Louis 1, Mo.

Traffic Studies. The importance of off-street parking facilities is emphasized in *The Traffic Design of Parking Garages*, prepared by Edmund R. Ricker, Jun. ASCE, research assistant in transportation at Yale University, under a grant of the Eno Foundation. Copies may be obtained without charge from the Eno Foundation for Highway Traffic Control at Saugatuck, Conn.

Structural Research. Analytical and experimental investigations of column action, carried out in the Cornell University Engineering Experiment Station, are reported in Bulletin No. 36 under the title, *Buckling of Trusses and Rigid Frames*. The bulletin may be purchased from the Cornell University Press, 124 Roberts Place, Ithaca, N.Y., for 80 cents.

Highway Studies. An engineering analysis of city, county, and state road problems in Washington, made for the state legislature under direction of a staff loaned by the Automotive Safety Foundation, has been published under the title, *Highways in Washington's Future*. The 84-page report includes a long-range program for development of a safe and efficient transportation network for the state. G. Donald Kennedy, M. ASCE, vice-president of the Automotive Safety Foundation, headed the engineering staff in charge of the study.

Dam Construction. Two descriptive pamphlets on the Harlan County Dam and Kanapolis Dam, under construction by the Corps of Engineers as units in the Missouri Basin development program, have been issued by the Kansas City District of the Corps. Inquiries should be addressed to the Office of the District Engineer, Kansas City District, 601 Davidson Building, Kansas City 8, Mo.

Engineering Sources. A practical guide to engineering literature and data, entitled *Sources of Engineering Information*, has been published by the University of California Press. This 109-page reference work, designed especially for engineering students and practicing engineers, may be purchased from the University of California Press, Berkeley 4, Calif., at a cost of $4. The author, Blanche H. Dalton, is librarian of the Engineering Library at the University of California.

Traffic Control. Standard specifications for design and installation, as well as the principles governing selection and operation of various traffic control devices, are covered in a revision of the 1942 edition of *Manual on Uniform Traffic Control Devices for Streets and Highways*. The new edition has been prepared by the Joint Committee on Uniform Traffic Control Devices—consisting of representatives of the American Association of State Highway Officials, the Institute of Traffic Engineers, and the National Conference on Street and Highway Safety—and published by the Public Roads Administration. Orders for purchase of the manual, at 50 cents a copy, should be sent to the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Boston Society of Civil Engineers. As a feature of its centennial celebration, the Boston Society of Civil Engineers, oldest engineering organization in the country, issued a special section of its *Proceedings* for July. Papers outlining the contributions of BSCE members to "100 years of progress in civil engineering" comprise the supplement.

Flood Control. Records of stream gage heights and discharges for the North Mississippi floods of February 1948 are presented in Bulletin 66, a 55-page joint report of the U.S. Geological Survey and the Mississippi State Geological Survey. The bulletin, which was prepared under the direction of Irving E. Anderson, district engineer in the Jackson office of the U.S. Geological Survey, may be obtained from the Mississippi Geological Survey, University, Miss.

Safety Standard. A revision of the National Electrical Safety Code, NBS Handbook H30, as approved by the American Standards Association, has been issued by the Bureau of Standards. The safety code is now used by more than half of the states in their power transmission requirements, municipal governments, and other agencies. The 408-page code is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at $1.25 a copy.

Hydraulic Research. Issuance of Waterways Experiment Station Technical Memorandum No. 2–260, "Spillway for Detroit Dam, North Santiam River, Oregon," has been announced by the Army Corps of Engineers. Copies may be purchased from the Waterways Experiment Station, Vicksburg, Miss., at $1 each.

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Eye-Catcher

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NEWS OF Engineers

Samuel Murray will resume private practice as a civil engineer in Portland, Ore. For more than 46 years, Mr. Murray has served the Union Pacific Railroad, of recent years as resident engineer in the northwestern district, at Portland, Ore. Mr. Murray is credited with several engineering developments, including a bascule draw bridge and new methods of tunneling in unstable ground. He is a past-president of the Portland Section of the ASCE.

C. J. Knedel, formerly in the bridge department of the California State Division of Highways, at Sacramento, is to be associated with the Guy F. Atkinson Co., of San Francisco, Calif.

George H. Hargreaves has gone to Greece to work on irrigation projects for the U.S. Army Engineers. Mr. Hargreaves was previously an engineer in the Sacramento, Calif., office of the Bureau of Reclamation.

Comdr. Julian W. Silliman, of the Navy Civil Engineer Corps, will be transferred from Guam to Washington, D.C.

Robert N. Hill, previously assistant civil engineer in the California State Department of Finance at Sacramento, has been transferred to the Division of Architecture in Sacramento.

Maj. Gen. Philip B. Fleming, Federal Works Administrator, Public Works Agency, Washington, D.C., has accepted an appointment as United States member of the Permanent International Commission of the Permanent International Association of Navigation Congresses, which has its headquarters in Brussels. Colonel Fleming becomes chairman of the American section, succeeding **Col. Spencer Cosby,** who resigned.

James F. Halsey is now an assistant professor of hydraulic engineering at Louisiana State University. Professor Halsey graduated from the University of Illinois in 1947 and received his master's degree in August 1948 at Louisiana State University.

Cecil S. Camp has been appointed director of the School of Hydraulic Engineering at Louisiana State University, succeeding **Glen N. Cox,** who has gone to New York University. Professor Camp has taught at Oregon State College, Mississippi State College, Syracuse University, and since 1941 has been in charge of hydraulic and sanitary engineering courses at the University of Tennessee.

Thomas H. McCrackin, Jr., previously with the Azbe Corp., of St. Louis, Mo., has accepted a position with the Mississippi Valley Structural Steel Co., Maplewood, Mo.

J. H. Davies, head of the Long Beach, Calif., consulting firm of J. H. Davies & Associates, has opened a branch office in Santa Ana to serve Orange County. **Norman F. Rau** will be in charge of the new office, which will provide a complete structural and civil engineering service.

Dr. Theodor von Kármán, director of the Daniel Guggenheim Aeronautical Laboratory of the California Institute of Technology, was presented the Franklin Medal, highest award of the Franklin Institute, at a recent meeting. Dr. von Kármán was honored for his contributions to the development of advanced aerodynamic conceptions.

T. D. Mylrea, head of the department of civil engineering in the University of Delaware School of Engineering, has relinquished the chairmanship to **Dr. Julian W. Shields,** professor of theoretical and applied mechanics, because of ill health. Professor Mylrea, since 1934 chairman of the department, retains his rank as professor and his instructional work.

John E. Brumbaugh has been appointed city engineer of Briarcliff Manor, N.Y. He was village engineer from 1940 to 1946.

W. L. Shannon was recently made director of the North Pacific Division Testing Laboratory, Corps of Engineers, Portland, Ore. Mr. Shannon was formerly at the Graduate School of Engineering, Harvard University, as research associate in soil mechanics engaged on a research project in connection with studies for a possible sea-level canal at Panama.

Fred G. Schurman has accepted the position of chief engineer for the Saudi Arabia Government Rail & Port Division at Damman, where he will be in charge of the construction, operation, and maintenance of the railroad and port facilities. He was formerly with the Union Pacific Railroad, with headquarters at Omaha, Nebr.

ASCE HONORARY MEMBER CHARLES P. BERKEY, professor emeritus of geology at Columbia University, receives first award of Kemp Medal "for distinguished service in geology" from Gen. Dwight D. Eisenhower, president of Columbia, at recent testimonial dinner at Men's Faculty Club. Associated with Columbia since 1903, Dr. Berkey has served for many years as consultant to New York City Board of Water Supply and numerous other public service organizations. Kemp Medal was established last year in honor of late James Furman Kemp, founder of geology department at Columbia, and pioneer in field of engineering geology.

William F. Moehlman, who was recently honored by reelection to a second term as president of the Knoxville, Tenn., Chamber of Commerce (see CIVIL ENGINEERING for October, page 66), is vice-president of the Tennessee Metal Culvert Co. and president of Knox-Blox, Knox Concrete Products, Inc., in addition to the connections mentioned in the item in the October issue.

Edward A. Beck has become town manager of Pulaski, Va. Mr. Beck was a lieutenant in the Navy Civil Engineer Corps during the recent war.

Truman A. Smith, formerly with J. P. Ewin, Inc., Mobile, Ala., is a consultant for the Alabama state docks, replacing the late **J. P. Ewin.**

Ray V. Tilly has resigned his post as superintendent of highways for Sangamon County, Illinois, after 10 years of service, to accept a position with the engineering concern of Crawford, Murphy & Tilly.

Ross J. Buck, of Edinburg, Ind., has been made city engineer of Bloomington, Ind., succeeding **Worth Yoder,** who resigned. Mr. Buck was previously connected with the Charles H. Hurd Engineering Co., of Bloomington, as chief engineer.

Robert V. Phillips, previously office engineer for the Los Angeles, Calif., Water & Power Department, at Independence, Calif., will manage field and office engineering, hydrologic field work, and engineering laboratory operations of the aqueduct division of the department in Los Angeles.

Mons H. Benson is now head of the design unit for the Bureau of Reclamation at Boise, Idaho. Mr. Benson was formerly an engineer in the same regional office of the Bureau.

A. F. Porzelius, manager of the Chattanooga City Water Co., Chattanooga, Tenn., was presented the George W. Fuller Award for leadership in the water-works profession, at a recent meeting of the Kentucky-Tennessee section of the American Water Works Association in Chattanooga.

Maurice Dickinson has accepted a position with the San Francisco Power & Utilities Engineering Bureau, where he will be in charge of planning and designing new water supply and power developments for the city. Mr. Dickinson was with the TVA for more than 12 years.

E. A. Baugh, associated with Baugh & Scott of San Antonio, Tex., has been elected to the board of directors of the San Antonio Builders Exchange. **E. W. Robinson,** retired, has been president of the Exchange for the past three years and is still on the board of directors.

Edmund B. Besselievre, sanitary expert for the foreign division of the Dorr Co., Inc., New York City, will make his headquarters in São Paulo, Brazil, where he will generally assist his company's representative in the handling of various sewage and water treatment projects.

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Enoch R. Needles

Enoch R. Needles, former ASCE Director, and member of the New York and Kansas City, Mo., consulting firm of Needles, Tammen & Bergendoff, has been nominated for president of the American Road Builders' Association for 1949. Mr. Needles, whose consulting practice was established in 1928, is a specialist in the design and construction of bridges, both fixed and movable. This work has included the design of the Burlington-Bristol vertical-lift span over the Delaware River, the first structure to provide a movable span over a 500-ft navigable channel, and the design of the Missouri River bridge at South Omaha, Nebr. His firm acted in an advisory capacity on the construction of the Pulaski Skyway, and on the design of the Harlem River and Bronx Kills crossings, of the Triborough Bridge in New York City.

Jack D. Brown has been promoted from assistant civil engineer to district engineer in the West Texas division office of the Humble Oil & Refining Co., at Odessa, Tex. **Henry E. Meadows**, previously assistant division civil engineer at Odessa, has been appointed division civil engineer in the same office. **Lloyd O. Zapp**, until lately assistant division engineer of the Southwest Texas division of the organization, has been promoted to senior supervising engineer in the Houston, Tex., office.

Joe Clyde Gilbreth has established a private consulting practice in San Antonio, Tex. Mr. Gilbreth was formerly with Lockwood & Andrews, consulting firm of Houston, Tex., as structural engineer.

Charles C. Whittelsey was recently elected vice-president in charge of construction activities for Ford, Bacon & Davis, engineers-constructors, with offices in New York, Philadelphia, Chicago, and Los Angeles. Mr. Whittelsey has also been elected executive vice-president of the firm's subsidiary, Ford, Bacon & Davis Corp., with headquarters at Monroe, La. With the concern since 1925, Mr. Whittelsey has been an officer and director for several years and has had charge of the engineering and construction of many of the large-scale projects handled by the company.

J. H. Lehman and **Samuel Schultz** have formed a consulting engineering partnership to practice in Los Angeles, Calif. Mr. Lehman was formerly associated with Wailes-Bageman, Inc., as a civil engineer in a technical advisory service on concrete and with the Austin Co. Mr. Schultz was previously structural designer with Norman Green, and more recently with the structural engineering concern of Henry M. Layne, as chief engineer.

Frank M. Cortelyou, E. M. Newman, and **F. M. Cortelyou, Jr.,** announce the formation of a partnership under the name of Harrington & Cortelyou, Kansas City, Mo., to continue the engineering practice formerly conducted by the late John Lyle Harrington and Frank Cortelyou.

Fred R. McComb has been appointed district engineer of the Minneapolis office of the Portland Cement Association, succeeding **Frank S. Altman**, who has retired from active service after 28 years. For the past 12 years Mr. McComb has been field engineer for the organization in Indianapolis, Ind., except for three and a half years service in the U. S. Army Corps of Engineers.

Robert R. Philippe, senior engineer in the Ohio River Division Engineer Office, U.S. Engineers, Mariemont, Ohio, and **R. N. Bergendoff**, of Howard, Needles, Tammen & Bergendoff, Kansas City, Mo., will serve as part-time lecturers in foundation and structural engineering, respectively, at the University of Illinois. **C. T. Bagley**, Maj., Corps of Engineers, Champaign, Ill., is part-time visiting assistant professor. New instructors in the civil engineering department are **D. A. Day**, previously field superintendent for the Raymond Concrete Pile Co., New York City, and **G. A. Young**, formerly assistant structural engineer for the Harza Engineering Co., Chicago, Ill. **E. E. Bauer** and **G. H. Dell** have been promoted from the position of assistant professor to associate professorships in the civil engineering department. **C. P. Atkins** and **J. C. Guillou** have been advanced to assistant professors, **J. W. Seyler** to instructor, and **W. J. Austin** to research associate.

Deceased

Sidney Francis Bamberger (Assoc. M. '43) partner in the San Francisco firm of Bamberger & Reid, died on September 18. Mr. Bamberger, who was 36, was chief engineer for Mark Falk, San Francisco consultant, from 1937 to 1942. During World War II, he was chief structural engineer for the Pollock-Stockton Shipbuilding Co. on the construction of steel floating drydocks, and later held a similar position with Kump & Falk. Since 1946 he had been in private practice with John L. Reid.

Edwin James Beugler (M. '04) retired consultant of Cheshire, Conn., died on September 12, at the age of 79. From 1905 to 1920, Mr. Beugler was consulting engineer for Westinghouse, Church, Kerr & Co., Inc., of New York, on the design and construction of harbor works and power plants here and abroad. He then became vice-president of the Foundation Co., of New York, and of more recent years had had a consulting practice in Cheshire. Long interested in professional aspects of engineering, Mr. Beugler served as the first secretary of the Connecticut State Registration Board from 1935 to 1941.

Victor Hugo Cochrane (M. '10) consulting engineer of Tulsa, Okla., died there on September 27, at the age of 69. Mr. Cochrane began his engineering career in Kansas City, Mo., where he was a member of the firm of Hedrick & Cochrane from 1910 to 1916 and bridge engineer for the city from 1916 to 1918. In 1919, after a year as major in the Construction Division of the Army, Mr. Cochrane established his own practice in Tulsa, and since 1944 he had been a member of the firm of Cochrane, Hendrix, Fell & Wheeler. He had supervised construction of some of the state's largest projects, including the Grand River and Wister dams.

George McClellan Derby (M. '96) retired colonel in the Army Corps of Engineers, New Orleans, La., died in a hospital there on October 24. He would have been 92 on November 1. One of the oldest graduates of the U.S. Military Academy at West Point, Colonel Derby was a member of the class of 1878. He had taught at the Academy; served as assistant engineer on a project to make Hell Gate in the East River, New York City, navigable; and been in charge of the Fourth Mississippi River Commission District (now the New Orleans District Engineer Office). Active in flood control work, he was in charge of Mississippi River flood control in the Fourth District during World War I. During the Spanish-American War he commanded the Fifth Army Engineer Corps.

Clark Dillenbeck (M. '04) of Plainfield, N.J., died there on October 9, at the age of 82. At the time of his retirement ten years ago, Mr. Dillenbeck had been with the Reading Railroad for almost 50 years—since 1927 in the post of chief engineer. Before joining the Reading staff in 1890, Mr. Dillenbeck was with the John G. Ferris Steel Co. in Pittsburgh.

Floyd Sinnock Hewes (Assoc. M. '13) office engineer for the Atchison, Topeka & Santa Fe Railway, Chicago, Ill., died in that city on March 3, though the Society has just heard of his death. Mr. Hewes, who was 64, had spent his entire career with the Atchison, Topeka & Santa Fe, having gone there as a rodman in 1905. He was stationed in various parts of the country, and since 1927 had been office engineer at Chicago.

George Evarts Low (Assoc. M. '98) retired New York engineer, died in a hospital in Brattleboro, Vt., on October 22. His age was 75. Following his graduation from Columbia University in 1893, Mr. Low was employed in the New York City engineering department until 1901. For the next 30 years he was president of the Low Parker Engineering Co., with offices in New York. For many years a resident of Maplewood, N.J., Mr. Low was in charge of planning and supervising the building program of the South Orange and Maplewood school system for 21 years.

Cole Manes, consulting engineer of Dallas, Tex., died on August 22, at the age of 48. Mr. Manes had been land and industrial engineer for the Texas & Pacific Railway, at Dallas; civil engineer with the Dallas firm of Myers, Noyes & Forrest; and

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Joseph Eugene Root (M. '18) Cincinnati consultant and former director of public works, died on August 13, at the age of 69. Mr. Root was assistant city engineer of Cincinnati from 1912 to 1918 and chief engineer of the Akron Department of Sewers from the latter year to 1927. He then became special engineer in charge of coordination for the planning and construction of the Cincinnati Union Terminal, and from 1931 to 1943 he was director of the Cincinnati Department of Public Works. Mr. Root had been active in the Society, which he served as Director from 1938 to 1940, and he was a former president of the Cincinnati Section. He was a past-president of the American Public Works Association and the International Association of Public Works Officials. Long interested in professional aspects of engineering, Mr. Root helped draft the present Ohio registration law for engineers and surveyors.

Joseph E. Root

Nathaniel Levin Marks, Jr. (M. '43) city engineer of New Orleans, La., died on September 30, at the age of 50. A graduate of Tulane University, class of 1924, Mr. Marks had been in the employ of the city since 1925, serving successively as assistant engineer, principal assistant and, since 1935, city engineer. In the latter capacity, Mr. Marks was in charge of various WPA improvement projects for the city.

Richard Ray Mitchell (Assoc. M. '20) of Ogden, Utah, died on April 15, according to word just received at Society Headquarters. He was 66. Mr. Mitchell retired on January 1 1948, from the position of senior highway engineer for the Public Roads Administration at Ogden after 35 years with the PRA and its predecessor, the U.S. Bureau of Public Roads.

Julio Daniel Montero (M. '18) partner in the firm of Hijos de Diego, Montero, Havana, Cuba, died on September 5, at the age of 65. A native of Cuba, Mr. Montero was educated at Rensselaer Polytechnic Institute and Havana University. He spent his early career in the Cuba Department of Public Works, and for many years prior to his death had been a member of the engineering firm of Hijos de Diego, Montero.

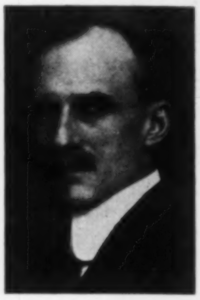
Leslie Muller, of Shelton, Wash., died at his home on Island Lake, Wash., on April 30, according to word just received at ASCE Headquarters. Mr. Muller, who was 78, spent his early career in railroad work. Later he was assistant superintendent of concrete construction for the Hoboken terminal of the Hudson & Manhattan Railroad, and assistant engineer on subway construction in New York City.

Oscar Shanks (M. '06) retired construction engineer for Swift & Co., Chicago, Ill., died in that city on September 20. Mr. Shanks, who was 72, was with Swift & Co. for many years prior to his retirement in 1936. During World War I, he was in charge of the organization's construction work in South America.

Alfred Yngve Sundstrom (M. '10) of Forest Hills, N.Y., died recently. He was 75. A native of Sweden, Mr. Sundstrom was educated here and spent his early career with the Pennsylvania Steel Co. For many years he was with Byington & Co., New York City engineering and contracting firm.

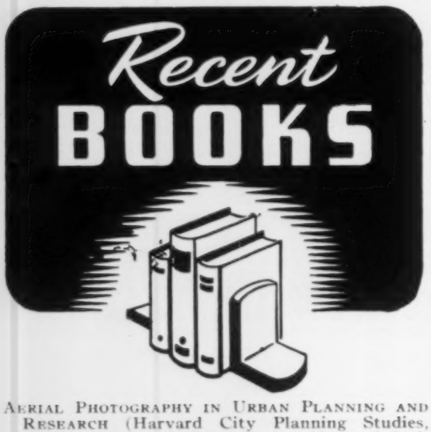
Clark Chittenden Wright (M. '19) member of the Chicago architectural and engineering firm of Carr & Wright, died in that city on October 12. He was 68. In 1915 Mr. Wright entered the architectural office of George C. Nimmons. Later he was admitted to partnership, and the firm name was changed to Nimmons, Carr & Wright. Two years ago the firm became Carr & Wright, Inc. During his long career, he was engaged in the design and construction of important buildings all over the United States, including numerous structures for Sears, Roebuck & Co. During the first World War, Mr. Wright served on the Quartermaster General's staff, holding the rank of colonel in the Construction Division.

Charles Wilkinson Staniford (M. '90) wh retired as consulting engineer of the Ne Jersey Harbor Commission, died in Newark N.J., on October 30 He was 87. An authority on the construction of harbo facilities, Mr. Staniford was chief engineer of the New York City Department o Docks and Ferries fo 15 years. He designed piers and sheds for the City of Sa Francisco after th earthquake and fir of 1906, and simila terminal facilities fo Camden, N.J., Portland, Ore., Tampa, Fla. and Quebec. In World War I, he was member of the Port Development Committee of the Council of National Defense, an after the war was appraiser in the government seizure of German piers in New Yor City and Hoboken, N.J., and of the Bus Terminal in Brooklyn. Prior to retiremen a few months ago, Mr. Staniford had bee consulting engineer for the New Jerse Harbor Commission for the past 15 years A veteran member of the Society, Mr. Staniford served as Director in 1912 and 1913.


C. W. Staniford

Joseph Andrew Tosi (M. 29) chief engineer for the E. J. Cross Co., of Worcester Mass., died at Sterling, Mass., on October 8 His age was 59. Mr. Tosi had been with th E. J. Cross Co., engineers and general contractors, since 1913, and he had been chie engineer since 1922. He was a founder o the Worcester Society of Civil Engineers.

Charles Thuringer (Assoc. M. '08) retired engineer of Madison, Wis., died on June 9 according to word just received at Society Headquarters. He was 77. Mr. Thuringe had been assistant engineer on the construction of the Pennsylvania Railroad's Eas River tunnels from Manhattan to Lon Island, and resident engineer on the reconstruction of the La Salle Street and Washington Street tunnel in Chicago. From 1910 to 1929 he maintained a real estate business i Madison, and from 1930 until his retirement in 1938 he was in the U.S. Engineer Office a Peoria, Ill.



Aerial Photography in Urban Planning and Research (Harvard City Planning Studies, XIV). by M. C. Branch, Jr. Harvard University Press, Cambridge, Mass., 1948. 150 pp., illus., diagrs., charts, maps, tables, 11×8½ in., paper, $3. Part I, on the use of spiral photographs, discusses the effective types, the methods of photographic mapping, and the cost of aerial surveys. Part II deals with the special knowledge prerequisite to the effective use of air photos, including information on photoruns and plotting mosaics, flight planning, equipment, and photographic interpretation.

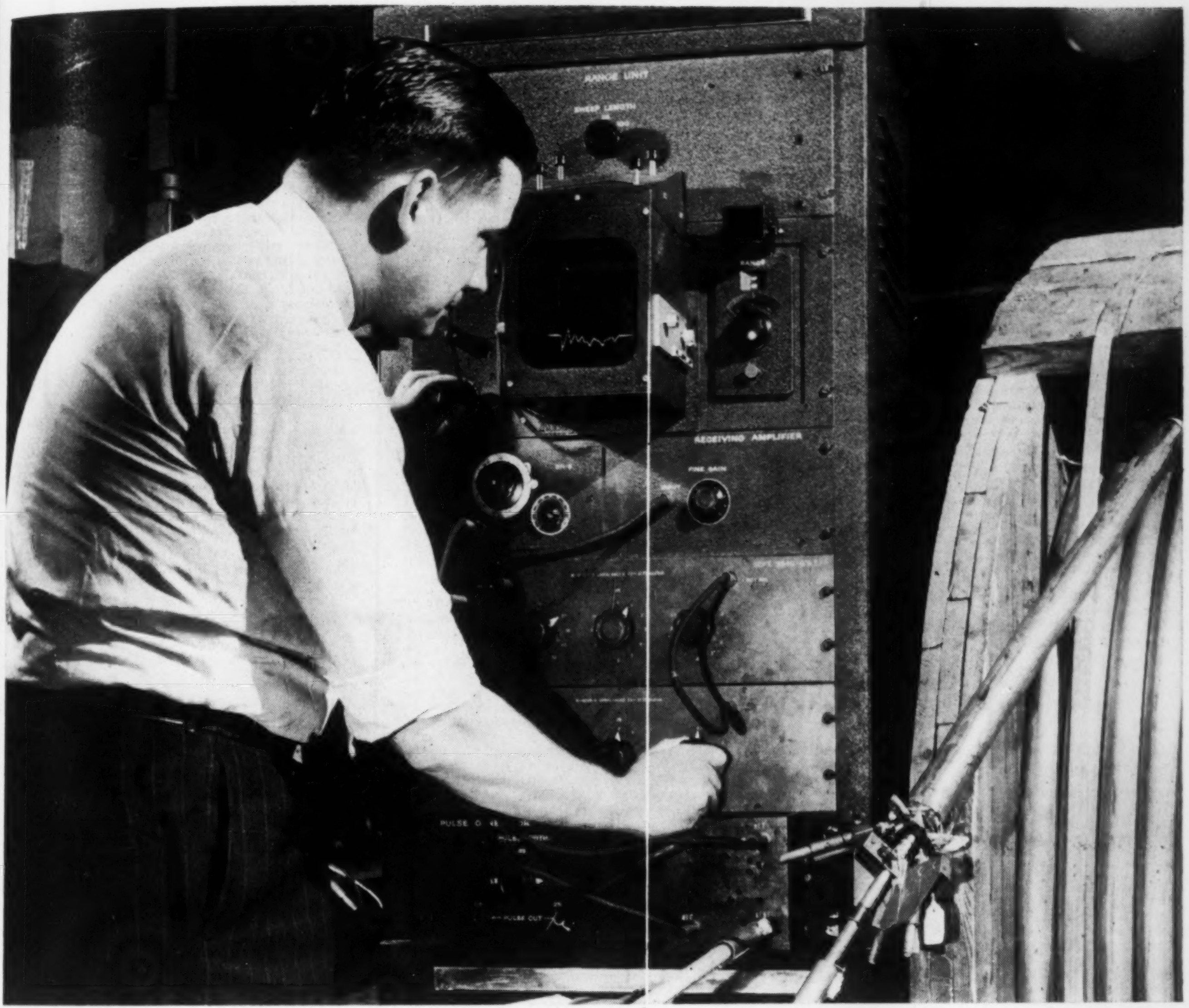
Concrete Materials and Practice. By L. J. Murdock. Longmans, Green & Co., New York; Edward Arnold & Co., London, 1948. 328 pp., illus., diagrs., charts, tables, 9×5¼ in., cloth, $5.25; 21s. This book provides a broad outline of the science of concrete making, emphasizing practical applications. The properties of concrete, basic materials, and techniques of making concrete under various conditions and for various purposes are discussed in detail. Brief mention is made of the design of reinforced concrete. A bibliography and a section on British, American, and metric equivalents are included.

Design of Welded Steel Structures, 2 ed. By A. R. Moon. Sir Isaac Pitman & Sons, Ltd., London, 1948. 134 pp., diagrs., tables, 8¾×5½ in., cloth, 18s. This textbook provides in concise form the necessary practical information to enable engineers and designers of constructio steel work to make effective use of the welding process. It covers the essentials of good design, metals suitable for welding, weld forms, and welding procedures. Typical joints and structural units are worked out, and hints for avoiding distortion in the finished work are given.

Engineering Contracts and Specifications, 2 ed. By R. W. Abbett. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London, 1948. 327 pp., charts, 8½×5½ in., cloth, $3.75. The purpose of this book is to present some of the legal and business aspects of the engineering profession. In contrast to the first edition, increased emphasis is placed upon contract procedure for private work, although the original material on government methods has been retained and brought up to date. An entirely new chapter on construction insurance has been added, and the sections on prequalification and arbitration have been rewritten and expanded. Much new material on specification writing has been added.

Engineering Materials. By A. H. White. 2 ed. McGraw-Hill Book Co., New York, Tor-

(Continued on page 88)



He asks an echo

Radar sends out pulses of electric waves which, reflected from a target, return to reveal the target's location.

Likewise, the apparatus pictured above sends electric waves over a coaxial telephone cable. Minute irregularities reflect the waves back to their origin; the echo makes a trace on an oscilloscope screen and so tells where to look for the trouble.

Telephone messages need smooth "highways" over which to travel across country: circuits able to transmit every talking frequency, without distortion. Television needs even smoother highways and at many more frequencies. So Bell Laboratories devised this method of spot-testing the cable over the entire frequency band needed for telephone or television. It is so delicate that any possible interference with transmission is detected at once. Its use makes sure that every inch of highway is clear.

This is another important example of how Bell Telephone Laboratories constantly develop finer communications for the nation.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for continued improvements and economies in telephone service.

(*Continued from page 86*)

onto, London, 1948. 686 pp., illus., diagrs. charts, maps, tables, $9^1/_4\times6$ in., cloth, \$6. The various aspects of engineering materials are presented, with enough theoretical explanation so that the engineering student may understand the materials he uses. The book has been revised throughout, especially the chapters on alloy steels and light metals. The material on wood, plywood and other laminates, and protective coatings, is almost all new. The diagrams have been redrawn and new illustrations added. There are no problems included.

Fireproof Construction. By W. C. Voss. D. Van Nostrand Co., Inc., Toronto, New York, London, 1948. 286 pp., illus., diagrs., charts, tables, $9^1/_4\times6$ in., cloth, \$6. Illustrating the accepted fundamental practice in each of the various stages of building construction, this volume supplies a basis for extended discussion and for innovations which do not violate basic principles. Each phase of construction of fire-resistant buildings is considered individually from preliminary work and rock excavation to interior finish and building services. Many diagrams illustrate the text.

Fracturing of Metals, a Seminar on the Fracturing of Metals held during the twenty-ninth National Metal Congress and Exposition, Chicago, October 18 to 24, 1947. American Society for Metals, Cleveland, Ohio, 1948. 311 pp., illus., diagrs., charts, tables, $9^1/_4\times6$ in., cloth, \$5. Composed of papers dealing with an extremely complex problem, this volume does not claim to be a complete and correlated picture of the laws of fracture. Rather it deals with the specific phases which concerned members of the ASM seminar. Such varied topics as micro-mechanism of fracture, notched tensile testing, and theory of static fatigue for brittle solids are considered in the 19 papers included.

Introduction to Highway Engineering, 5 ed. By J. H. Bateman. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1948. 538 pp., illus., diagrs., charts, maps, tables, $9^1/_4\times5^3/_4$ in., cloth, \$5.50. In addition to fundamentals, this comprehensive text includes practical examples and problems. In the revised edition material has been added on highway traffic surveys, soil-cement and bituminous-cell base courses, concrete mixtures, and the use of air-entraining cement or air-entraining admixtures. The material on highway subgrade soils has been reworked.

(The) Location of Economic Activity. By E. M. Hoover. McGraw-Hill Book Co., New York, Toronto, London, 1948. 310 pp., diagrs., charts, maps, tables, $9^1/_4\times6$ in., cloth, \$3.75. This book presents an organized body of principles relating to the physical location of economic activities. It is primarily analytical rather than descriptive, devoting particular attention to problems of locational change and adjustment, and to objectives, methods, and implications of policies of public control. It develops ideas on the selection of locations for private and public facilities, land utilization, metropolitan and regional planning, and programs of industrial development and stabilization at local, state, regional, and national levels.

Major Types of Earth Construction, PB-53911, Office of Technical Services, Dept. of Commerce, Washington, D.C. Hobart Publishing Co., Box 4127 Chevy Chase Branch, Washington 15, D.C., 1947. 73 pp., diagrs., tables, $10^1/_2\times8$ in., paper, \$5. The characteristics, properties, and methods of construction are given, in condensed form, for all of the important types of construction using earth as a main material. Rammed earth, pressed earth blocks, and adobe are considered both with and without a stabilizing component. Soil mechanics as applied to earth construction is briefly discussed. There is a bibliography.

Mechanics of Materials. By G. Murphy. Irwin-Farnham Publishing Co., Chicago, Ill., 1948. 310 pp., illus., diagrs., charts, tables, $9^1/_4\times6$ in., cloth, \$4.50. To develop the student's understanding of the behavior under load of structural members and machine parts, this book emphasizes principles, considers standard procedures of analysis, and provides indications that our knowledge of materials is constantly growing. The principles of statics, the characteristics of the geometry of the loaded member, and the effects of the properties of the material are stressed. Discussion of topics comprising the first course in strength of materials is included.

(The) Metric System of Weights and Measures, the National Council of Teachers of Mathematics, Twentieth Yearbook, compiled by the Committee on the Metric System, J. T. Johnson, Chairman. Bureau of Publications, Teachers College, Columbia University, New York, 1948. 303 pp., illus., diagrs., tables, charts, maps $9^1/_2\times6$ in., cloth, \$3. This volume supplies a comprehensive view of metric usage at the present time as reported by 60 individuals and numerous organized groups active in widely varied fields. It surveys the history, nature, and advantages of the metric system and offers specific programs for its adoption both in general use and in the classroom throughout the United States and the British Empire.

Molybdenum, Steels, Irons, Alloys. By R. S. Archer, J. Z. Briggs and C. M. Loeb, Jr. Climax Molybdenum Co., New York, 1948. 391 pp., diagrs., charts, tables, $9^1/_4 \times 6$ in., fabrikoid, limited free distribution. This monograph deals with the properties of molybdenum and its uses in ferrous and non-ferrous alloys. The fundamental effects of heat treatment on microstructure are considered as well as the addition of molybdenum to alloys. Each different alloy is considered individually. The appendices contain many useful charts. Each of the ten sections is followed by an extensive bibliography.

N.F.P.A. Handbook of Fire Protection. By Crosby-Fiske-Forster. 10th ed. National Fire Protection Association, 60 Batterymarch St., Boston, Mass., 1948. 1,544 pp., illus., diagrs., charts, tables, $7^3/_4\times5$ in., fabrikoid, \$9.50. This book, like its predescessors, aims to present in compact form, for ready reference, all the essential information on fire prevention that time has stabilized into good practice. Among the new features are a chapter on chemistry and physics of fire, a chapter on water spray protection, and a complete new treatment of the general field of building construction. The new chapter on magnesium and other combustible metals outlines fire hazards and methods of protection. A table of trade names of plastics gives the properties of each. The book is useful to experienced fire protection engineers as well as to students of fire protection, inspectors, and property owners.

National Conference on Industrial Hydraulics, Proceedings, third Annual Meeting, October 16–17, 1947. Armour Research Foundation, Technology Center, Chicago 16, Ill., 1948. 129 pp., illus., diagrs., charts, tables, 9×6 in., paper \$3. The conference attempts to fulfill a need for an interchange of ideas on problems confronted in the large field of industrial hydraulics. The papers from the third meeting deal with hydraulic governor operation, hydraulic circuits of industrial process controls, various phases of cavitation, practical hydraulic coupling design modifications, hydraulic transmissions, and the design of hydraulic seals.

Piling for Foundations. By R. R. Minikin. Crosby Lockwood & Son, Ltd., London, 1948. 196 pp., illus., diagrs., charts, tables, $9\times5^1/_2$ in., cloth, 15s. Useful to students, designers, and field engineers, this book presents those factors of economic design and practical efficiency derived from the author's experience and from the successful works of colleagues. Practical examples of the design and use of piling are given from modern practice, particularly of construction operations that are usually productive of site difficulties. They include industrial buildings, bridges, marine works, cofferdams, and a variety of ancillary works.

Practical Problems in Soil Mechanics. By H. R. Reynolds and P. Protopapadakis. Crosby Lockwood & Son, Ltd., London, 1948. 205 pp., illus., diagrs., charts, tables, $9\times5^1/_2$ in., cloth, 18s. The object of the authors has been to present in as simple a form as possible the application of soil-mechanics methods and analyses to practical problems such as may occur in the experience of the practicing engineer. The essential features of soil-mechanics studies have been assembled and discussed, with a minimum of mathematics, to provide a treatment bridging the gap between the theoretical textbook and actual practice.

(*Continued on page 90*)

Photogrammetric Methods Cut Time, Costs of City Surveys

(*Continued from page 35*)

Industrial Land Use and Material Storage. Here again the over-all picture can be studied with the composite mosaic; here, too, the topographic map is useful to both planner and engineer.

Traffic Flow Studies. Many cities need an up-to-date base map showing all streets and highways. The composite mosaic provides an excellent base for a traffic flow map.

Intersection Analysis Studies. Enlarged individual photos, together with stereoscopic prints, afford excellent media for the study of conditions at individual street intersections. While field work is required in such studies, the enlarged photograph, which is overlaid with a transparent sheet, provides a splendid base on which to record street width, curb radii, hedge heights, and similar data.

Transportation Studies. To meet the first requirement of such studies, namely, a good, over-all map of the city, the composite mosaic is indicated.

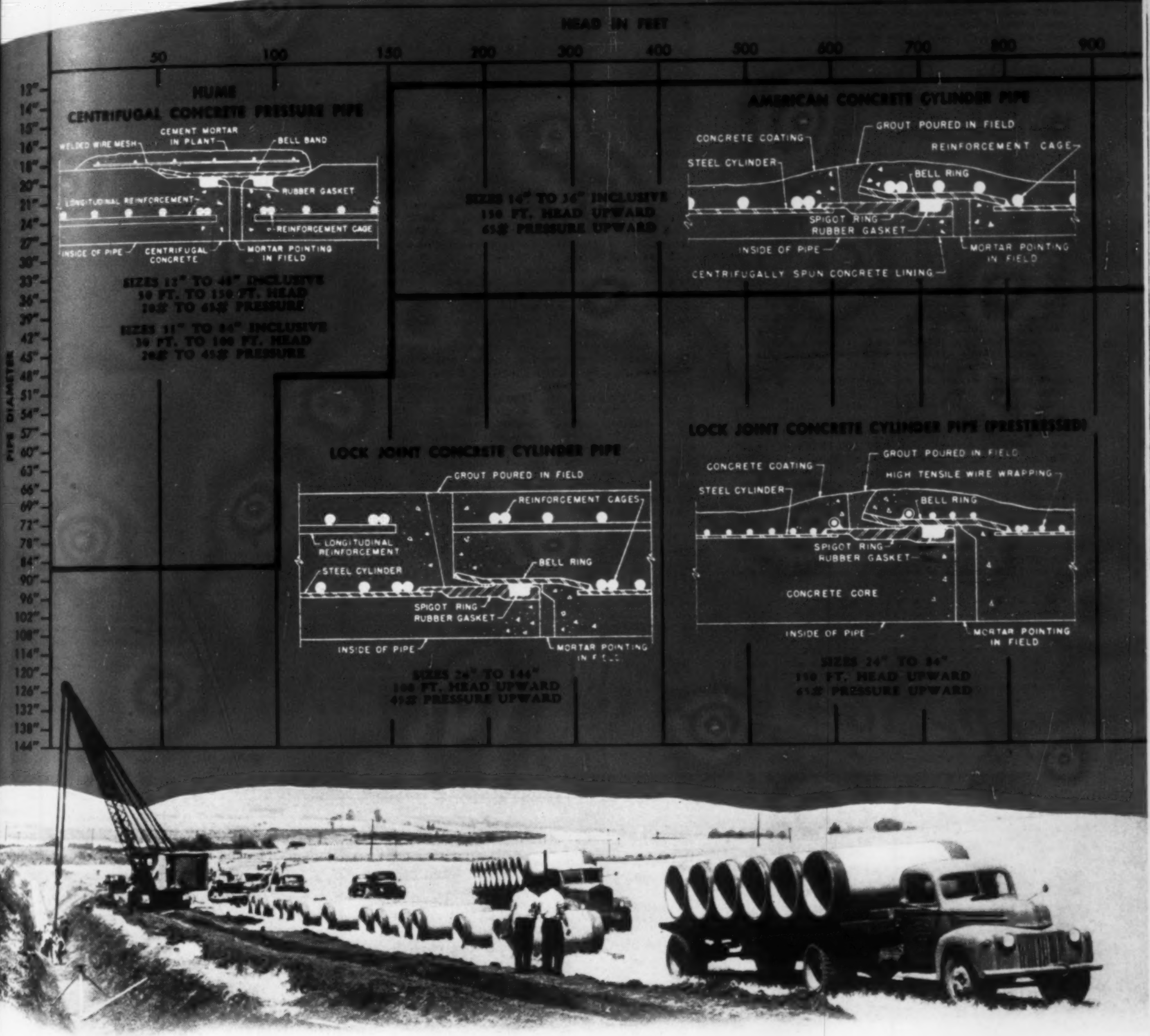
Property Location. In most cities property surveys are difficult because of inaccuracies in surveys made over a long period of time, and because of errors in deed recordings. Large-scale mosaics aid greatly in finding these errors. With the mosaic as a base map, almost any group of deeds can be plotted on a transparent overlay. Much field work can thus be saved. Large-scale mosaics may pay for themselves many times over in finding untaxed land.

Each city has its own planning and engineering problems. However, one problem is common to almost all map users. The city planner or engineer reads and understands maps well but his good thinking and planning must often be approved by groups and individuals who have little knowledge of engineering and little ability to read and understand maps. Most Americans pride themselves on their ability to read timetables, box scores, and maps, but the U.S. Army, which wrestled with this problem during the war, found out that many bright men cannot read a map.

At a recent meeting, the culmination of two years' careful planning was presented by some able engineers to a civic group. The plans were illustrated by maps but the maps were difficult for the laymen to understand and had little meaning for an audience composed of the chamber of commerce president, the head of the local bank, leading industrialists, the representatives of the Parent-Teachers Association, and other civic groups. Did a single one of these men stand up and say he could not read the maps? No, sir, the head of the bank would not admit to the president of the chamber of commerce that he could not follow the discussion. Nor would anyone else in the group. Had the engineers presented their plan by means of a photo relief model or a photo-topo map, this difficulty would not have arisen.

Western States

4 outstanding types of reinforced concrete pressure pipe cover range of water supply line construction


HEAD IN FEET
50
100
150
200
300
400
500
600
700
800
900
PIPE DIAMETER
12"
14"
15"
16"
18"
20"
21"
24"
27"
30"
33"
36"
39"
42"
45"
48"
51"
54"
57"
60"
63"
66"
69"
72"
78"
84"
90"
96"
102"
108"
114"
120"
126"
132"
138"
144"
HUME
CENTRIFUGAL CONCRETE PRESSURE PIPE
CEMENT MORTAR IN PLANT
WELDED WIRE MESH
BELL BAND
RUBBER GASKET
LONGITUDINAL REINFORCEMENT
REINFORCEMENT CAGE
INSIDE OF PIPE
CENTRIFUGAL CONCRETE
MORTAR POINTING IN FIELD
SIZES 12" TO 48" INCLUSIVE
30 FT. TO 150 FT. HEAD
20# TO 65# PRESSURE
SIZES 51" TO 84" INCLUSIVE
30 FT. TO 100 FT. HEAD
20# TO 45# PRESSURE
SIZES 14" TO 36" INCLUSIVE
150 FT. HEAD UPWARD
65# PRESSURE UPWARD
AMERICAN CONCRETE CYLINDER PIPE
GROUT POURED IN FIELD
CONCRETE COATING
REINFORCEMENT CAGE
STEEL CYLINDER
BELL RING
SPIGOT RING
RUBBER GASKET
INSIDE OF PIPE
MORTAR POINTING IN FIELD
CENTRIFUGALLY SPUN CONCRETE LINING
LOCK JOINT CONCRETE CYLINDER PIPE
GROUT POURED IN FIELD
REINFORCEMENT CAGES
LONGITUDINAL REINFORCEMENT
STEEL CYLINDER
BELL RING
SPIGOT RING
RUBBER GASKET
INSIDE OF PIPE
MORTAR POINTING IN FIELD
SIZES 24" TO 144"
100 FT. HEAD UPWARD
45# PRESSURE UPWARD
LOCK JOINT CONCRETE CYLINDER PIPE (PRESTRESSED)
GROUT POURED IN FIELD
CONCRETE COATING
HIGH TENSILE WIRE WRAPPING
STEEL CYLINDER
BELL RING
SPIGOT RING
RUBBER GASKET
CONCRETE CORE
INSIDE OF PIPE
MORTAR POINTING IN FIELD
SIZES 24" TO 84"
150 FT. HEAD UPWARD
65# PRESSURE UPWARD

In any permanent main water supply line project, savings in the cost of delivered water originate with the selection of superior pipeline products designed and manufactured to meet specific job requirements.

These four general classes of reinforced concrete pressure pipe manufactured by American are outstanding for main water supply line construction. Allowing for overlapping from one field to another because of special conditions related to specific installations, or because of the economical range of any of the four types of pipe, the chart shows the general field for each type consistent with the factors of size and pressure.

All are equally effective in their respective fields. Each incorporates the physical properties of steel with the structural properties, protection, and permanency of concrete. Each assures maximum economy in initial cost, ease of installation, sustained capacity, and trouble free service.

Consider these advantages in your project, and write for any additional information desired.

American
PIPE AND CONSTRUCTION CO.

Concrete Pipe for Main Water Supply Lines, Storm
and Sanitary Sewers, Subaqueous Pipe Lines

P. O. Box 3428, Terminal Annex, Los Angeles 54, California
Main Offices and Plant – 4635 Firestone Blvd., South Gate, Calif.
District Offices and Plants – Oakland • San Diego • Portland, Ore.

(Continued from page 88)

Public Health Engineering, Vol. 1. By E. B. Phelps and others. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1948. 655 pp., illus., diagrs., charts, tables, $8^1/_2 \times 5^1/_2$ in., cloth, $7.50. Written primarily for municipal and civil engineers who want to know what to design and build and why, this book covers the entire field of environmental sanitation. Its approach is through chemistry and the biological sciences. Divided into two parts: a discussion of the air contact, broadly defined to include atmosphere pollution from smoke, odors and noise, ventilation, illumination, and insect problems; and a discussion of water contact, including the uses and abuses of water resources, stream sanitation, sewage treatment, and conservation of water supplies. Food will be dealt with in Volume 2, to be published later.

Reinforced Concrete Designer's Handbook, 4 ed. By C. E. Reynolds. Concrete Publications, Ltd., 14 Dartmouth St., London, S.W.1, 1948. 351 pp., charts, tables, $9^3/_4 \times 6^1/_2$ in., cloth, 15s. Of interest to the designer and engineer, this volume considers the factors of design of reinforced concrete structures and describes numerous applications. Loads and pressures; calculations of bending moments and forces generally, and with reference to particular structures; and determination of stresses and the design of members are considered. No attempt is made to deal with construction except in so far as the work on the site affects that of the designer. The procedures recommended are in agreement with the 1948 British Standard code of practice for reinforced concrete buildings.

Sewerage Design and Specification. By L. B. Escritt. Contractors Record and Municipal Engineering, Lennox House, Norfolk St., London, W.C. 2, 1947. 293 pp., illus., diagrs., charts, maps, tables, $9^3/_4 \times 6$ in., cloth, 30*s*. Written for sewer designers, this British book explains the main principles of sewerage in a manner that should make the subject clear to the practical man. Broad outline as well as detail is discussed. Such topics are discussed as soil and surface water sewerage, land drainage, construction of sewers, man-holes and chambers, flushing and ventilation of sewers, and conditions of surcharge. A section is devoted to sewerage of coastal towns. A bibliography of 157 references, mostly to British publications, is included.

Story of James B. Eads, **Road to the Sea** and the Mississippi River. By F. Dorsey. Rinehart & Co., Inc., New York and Toronto, 1947. 340 pp., illus., $8^1/_2 \times 5^1/_2$ in., cloth, $4. The life and achievements of one of the great American engineers are described in narrative form in this well-documented biography. Taken in considerable part from contemporary publications, the book presents an authentic picture of the period as well as a full treatment of Eads' work from his first specialized equipment for recovering sunken treasure to his plan for a ship-railway across the Tehuantepec Isthmus. His greatest concern, however, was always the Mississippi, whether it was boats, control works, or the monumental bridge for which he is best remembered.

Surveying, 4 ed. By W. Norman Thomas. Longmans, Green & Co., New York; Edward Arnold & Co., London, 1948. 564 pp., illus., diagrs., charts, maps, tables, $8^3/_4 \times 5^1/_2$ in., cloth, 30s., $7.50. This standard British text describes in detail the instruments and procedures used for all kinds of surveying work: leveling, plane table surveying, curve ranging, earthwork calculations, triangulation, hydrographic, photographic and aerial surveying. Particular attention is paid to the adjustment of instruments, and a new chapter on the adjustment of errors has been added in this edition.

Symposium on Load Tests of Bearing Capacity of Soils. (Special Technical Publication No. 79.) 50th annual meeting, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 1948. 148 pp., illus., diagrs., charts, tables, 9 × 6 in., paper, $3.00; to A.S.T.M. members, $2.25. This volume is a compilation of recent information on the subject of load tests. The seven papers presented deal with applications of load test results to airport pavements and runways, pavement design, and cyclic load-test procedure. There are illustrations and much discussion. Also included is a bibliography of 76 references in addition to author's references.

Technical Descriptive Geometry. By B. L. Wellman. McGraw-Hill Book Co., New York, Toronto, London, 1948. 508 pp., diagrs., tables, $9^1/_4 \times 6$ in., cloth, $4. Providing students and draftsmen with a complete up-to-date treatment, this book is written in simple language and generously illustrated. It begins with the most elementary concepts and progresses by easy stages to the complex intersection and development problems found in modern applications. Practical situations have been emphasized, especially with respect to surfaces. Double-curved surfaces, so important in ship, automobile, and aircraft instruction, are given more than usual space.

Technical Writing. By K. Hendricks and L. A. Stoddart. Utah State Agricultural College, Logan, Utah, 1948. 117 pp., diagrs., charts, maps, tables, $9^1/_4 \times 6$ in., cloth, $1.50. Designed as a text for the student in technical writing, this book will serve as a quick reference manual for the experienced research worker. Every phase of research writing with the exception of sentence and paragraph construction is included. Emphasis is placed upon the gathering of material, the collecting of data and the handling of illustrations, footnotes, and cross references. Methods of exploring a field and recording the findings are considered.

Thermodynamics. By E. F. Obert. McGraw-Hill Book Co., New York, Toronto, London, 1948. 571 pp., illus., diagrs., charts, tables, $9^1/_4 \times 6$ in., cloth, $5.50. Intended for use by engineering students, this fundamental text presents a comprehensive treatment of the subject. It provides certain essential material that must be understood by the practicing engineer, and considerable stress is placed upon real machines, flow processes, and the properties of fluids. An entire chapter is devoted to the concept of reversibility. An introductory chapter deals with dimensions and units.

Water Purification Control. By E. S. Hopkins. 3 ed. Williams & Wilkins Co., Baltimore, Md., 1948. 289 pp., illus., diagrs., charts, tables, $7^3/_4 \times 5^1/_2$ in., cloth, $4. This is a practical guide for operators of water purification plants. Revised to conform with modern practice, it is based on the author's own experiences at the Montebello Filters in Baltimore and elsewhere. A new section on the removal of iron and manganese has been added.

APPLICATIONS FOR ADMISSION OR TRANSFER

December 1, 1948

Number 12

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in Civil Engineering *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to co-operate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

Anand, Dharam Bir (Age 39) Superintending Engr., Elec. Grid, Bombay Govt.; at present in United States on deputation from India studying design and construction methods with Corps of Engrs., TVA, etc.

Armour, Cecil Alexander Vining (Age 45) Assoc. Prof. of Civ. Eng., Univ. of So. Calif., Los Angeles, Calif.

Baldock, Robert Hugh (Age 59) State Highway Engr., Salem, Ore.

Bassett, William Manning (Assoc. M.) (Age 67) Civ. Eng. Consultant, New England Power Service Co., Boston, Mass.

Bespalow, Eugene Frederick (Assoc. M.) (Age 48) Vice-Pres., Choctaw, Inc., Memphis, Tenn.

Bodhe, Janardan Ganpatrao (Age 38) Member of firm, Messrs. K. R. Irani & Co. of Bombay, Cons. Civ. Engrs., Ft. Bombay, India.

Bollong, James William Archibald (Age 63) Traffic Engr., Seattle, Wash.

Butkiewicz, Joseph Wallace (Assoc. M.) (Age 39) Asst. Civ. Engr., Board of Water Supply, New York City.

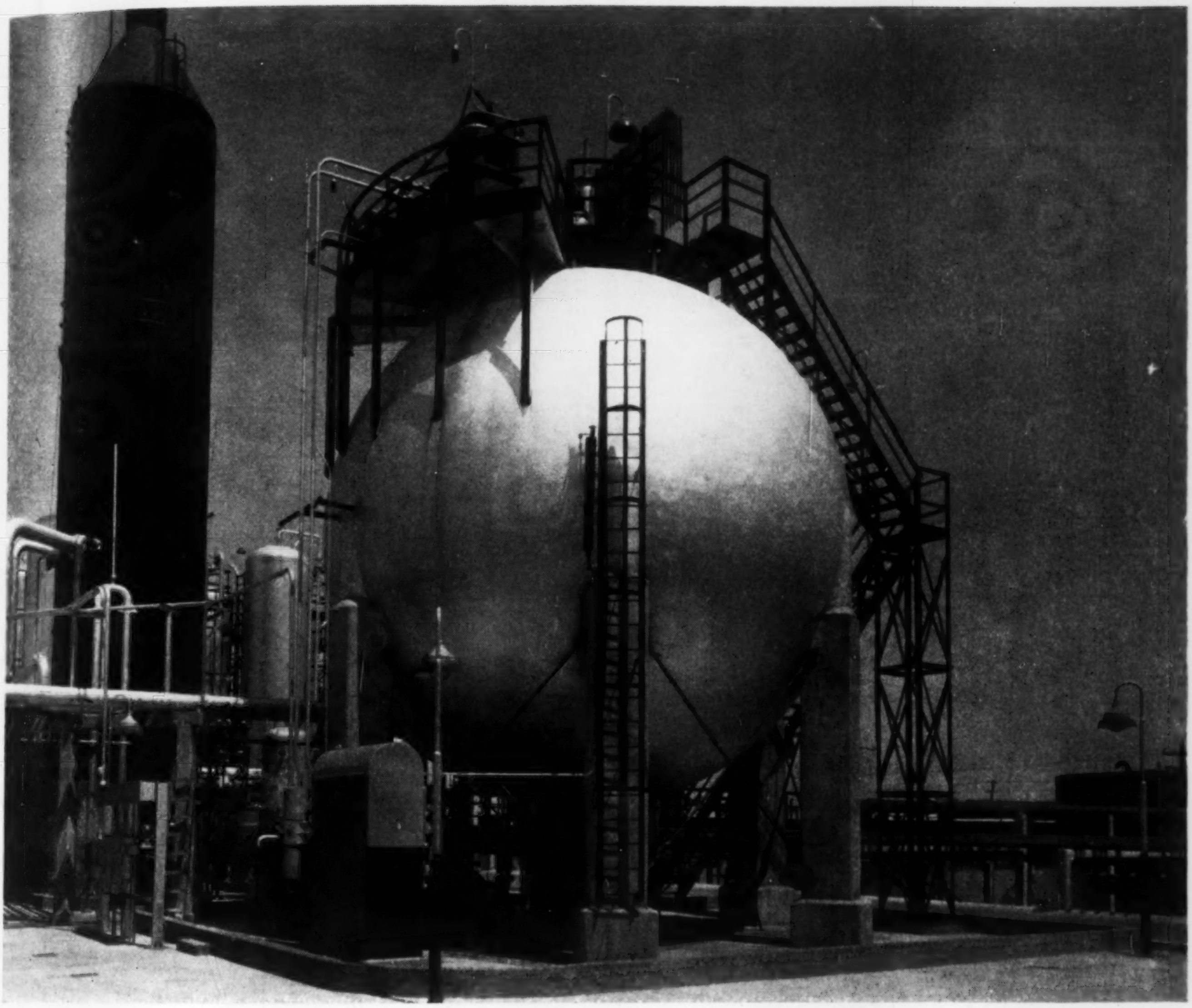
Delinks, Joseph Adam (Age 42) Struct. Engr. U.S. Atomic Energy Comm., Dept. of Public Works, Oak Ridge, Tenn.

Erps, Harry Richard (Age 57) Div. Bridge Engr., Public Roads Administration, Div. 2, Washington, D.C.

Evers, Charles Edmund, Jr. (Assoc. M.) (Age 48) Civ. Engr., J. Gordon Turnbull, Inc., Kansas City, Mo.

Facey, Fred William, Jr. (Age 41) Prin. Engr., P-6, Chf., Civ. Mil. Eng. Branch, Eng. Div., Savannah Dist. Office, Corps of Engrs., Savannah, Ga.

(Continued on page 92)



Outside it's a Hortonsphere, but inside . . .

THE FAMILIAR SPHERICAL SHAPE of the tank shown above identifies it as a Hortonsphere—the pressure storage unit well known in the petroleum industry as a container for highly volatile petroleum products.

But here it's fitted for another job—desalting crude oil at the Avon refinery of the Tidewater Associated Oil Company. Special electrical desalting equipment (some of it is visible on top) has been installed in the sphere by the Petroleum Rectifying Company to remove the salt from crude oil before the refining process begins. Crude with a high salt content causes a serious reduction in the efficiency and output of refinery units and necessitates shorter runs. The desalter shown above removes salt from an average of 30,000 bbls. of crude oil per day, the salt content of which is sometimes as high as 450 lbs. per thousand barrels.

The Hortonsphere is used in other industries, too, for the storage of such liquids and gases as anhydrous ammonia, hydrogen, and carbon monoxide, and it is widely used by municipal sewage disposal plants to store sewage digester gas which is valuable as fuel. It is an example of the versatility of the welded steel structures which we design, fabricate, and erect to meet the special needs of many industries. When you are making plans for steel plate work of this kind, ask our nearest office to send you detailed information and quotations.

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Cleveland 15 . . . . 2263 Guildhall Bldg.
Detroit 26 . . . . 1541 Lafayette Bldg.
Havana . . . . 402 Abreu Bldg.
Houston 2 . . . 2128 National Standard Bldg.
Los Angeles 14 . . . . 1456 Wm. Fox Bldg.
New York 6 . . . . . 3395-165 Broadway Bldg.
Philadelphia 3 . . 1652-1700 Walnut St. Bldg.
Salt Lake City 1 . 1509-1st Security Bk. Bldg.
San Francisco 11 . 1284-22 Battery St. Bldg.
Seattle . . . . 1309 Stuart Bldg.
Tulsa 3 . . . . 1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

(*Continued from page 90*)

Foss, Raymond John (Assoc. M.) (Age 53) Assoc. Prof., Univ. of N. Mex., Albuquerque, N.Mex.

Friend, Harold Lloyd (Assoc. M.) (Age 52) Senior Civ. Engr., Hanford Works, Gen. Elec. Co., Richland, Wash.

Gardner, Frank Henry (Assoc. M.) (Age 51) Highway Engr., U.S. PRA, Washington, D.C.

Hale, Frank Sherman (Age 46) Proj. Mgr., Naval Air Missile Test Center, Point Mugu, Calif.

Hubbell, George Edgar (Assoc. M.) Director, Hubbell, Roth & Clark, Inc., Cons. Engrs., Detroit, Mich.

Kell, Waldo Ralph (Age 49) Dist. Mgr., Raymond Concrete Pile Co., New York City; Kansas City, Mo.

Kohler, Karl O., Jr. (Age 43) Regional Engr., SCS, for work in Ore., Wash., Idaho, Calif., and Nev.; Portland, Ore.

Ladd, Edward Johnson (Age 42) Member of firm, Ladd Eng. Co., Ft. Payne, Ala.

Leavitt, Charles Paul (Age 46) Dist. Planning Engr., 5th Naval Dist., Norfolk, Va.

Liu, Hui Sien (Age 36) Chf., Ry. Sec., Representative's Office, Ministry of Communications of China, Washington, D.C.

McSwain, Kenneth Robinson (Age 37) Chf. Engr., Merced Irrigation Dist., Merced, Calif.

Marcello, Claudio (Age 47) Chf. Mgr., Edison Hydroelectric Power Office, Milan, Italy.

Miller, Arthur Charles (Age 37) Dist. Engr., Michael Baker, Jr., Inc., Jackson, Miss.

Robert, Harry Cooke, Jr. (Age 44) Engr., Special Design Dept., Robert & Co., Atlanta, Ga.

Rowland, Eugene Russell (Assoc. M.) (Age 37) Designer, Sverdrup & Parcel, St. Louis, Mo.; Kirkwood, Mo.

Sheldon, Robert Clinton (Assoc. M.) (Age 42) Private practice of Civ. Eng., Marietta, Ga.

Squires, Howard John (Age 42) Senior Asst., Messrs. Binnie, Deacon & Gourley, London, England; La Lima, Republic of Honduras, Care, United Fruit Co.

Sterns, Donald Elmer (Assoc. M.) (Age 44) Prof. and Chairman, Dept. of Civ. Eng., Syracuse Univ., Syracuse, N.Y.

Stoneburner, Clifton Godfrey (Assoc. M.) (Age 36) Highway Engr., Dept. of Public Service, Arlington, Va.

Underwood, Warren Nourse (Age 47) Dist. Engr., Guam Dist., Corps of Engrs., U.S. Army, APO 246, San Francisco, Calif.

Weiss, Theodore Francis (Assoc. M.) (Age 50) Civ. Engr. (Struct.), Triborough Bridge & Tunnel Authority, New York City.

Williams, Wayman C. (Age 52) First Asst., State Highway Engr., State Highway Comm., Salem, Ore.

FOR ASSOCIATE MEMBER

Aksoy, Ibrahim Sabit (Jun.) (Age 36) With Cemal Okguoglo (as a firm), on construction, Giresun, Turkey.

Allen, Arthur Egbert (Jun.) (Age 31) Hydr. Engr., Aluminum Co. of America, Pittsburgh, Pa.

Bauer, John Pancratios (Age 51) Asst. Engr., New York City Board of Water Supply, Liberty, N.Y.

Beach, David Myers (Age 39) Senior Highway Engr., U.S. PRA, Washington, D.C.

Briganti, Theodore (Jun.) (Age 34) Prin. San. Engr., Gen. Eng. Dept., Creole Petroleum Corp., Caracas, Venezuela.

Burkhart, Edsel Jay (Age 28) Research Asst., Tex. A. & M. College, College Station, Tex.

Calderon Corleto, Tiburcio (Jun.) (Age 34) Chf. Engr., Eng. Dept., Tegucigalpa, D.C.; Hondúras, C.A.

Cohn, Maurice Leonard (Jun.) (Age 34) Asst., Chf. Industrial Engr., Lily-Tulip Cup Corp., New York City.

Cordill, Albert Arnold (Age 30) Archt.-Supt., Charles H. McCauley, Archt., Birmingham, Ala.

Crockett, Argyle Campbell, Jr. (Jun.) (Age 35) Asst. Supt., Barge-Thompson Co., Atlanta, Ga.

Daniel, Robert Fleming (Age 29) Engr. (Geodetic), Army Map Service, Corps of Engrs., Washington, D.C.

Doddiah, Doddiah (Age 33) Asst. Engr., Govt. of Mysore, India, on deputation to United States in training with Bureau of Reclamation; student, Extension Centre, Univ. of Colo., Denver, Colo.

Escobar-Escobar, Daniel (Jun.) (Age 34) Head Des. Engr., Hydraulic Structures, Peruvian Govt.; Prof., Hydr. Eng., National School of Eng., Lima, Peru.

Gamsu, Frederick Conrad (Age 57) Owner and Administrator, Beaumart, Co., New York City.

Hoback, Wilford Dean (Age 39) Engr. of Urban Design, State Highway Dept., Oklahoma City, Okla.

Hoffman, Frank Howard (Age 49) Civ. Engr., Dept. of Water & Power, Los Angeles, Calif.

Holley, Myle Joseph, Jr. (Age 31) Asst. Prof., Struct. Eng., Mass. Inst. of Tech., Cambridge, Mass.

Jensen, John Allen (Age 30) Civ. Service Engr., U.S. Govt., Albuquerque, N.Mex.

Johnson, Melvern Edward (Jun.) (Age 34) Chf. Engr., and Production Mgr., Titan Metal Products Corp., Seattle, Wash.

Knapp, Charles Albert (Jun.) (Age 32) San. Engr., The Dorr Co., New York City.

Laflin, Eli Forbes (Jun.) (Age 35) Draftsman, Sverdrup & Parcel, Inc., San Francisco, Calif.; Berkeley, Calif.

Lightholder, Richard Kenneth (Jun.) (Age 36) Asst. Prof., Civ. Eng. Dept., Univ. of Pittsburgh; Member of firm, L. & L. Constr. Co., Canonsburg, Pa.

Looney, Thomas James (Age 41) Engr., P-5, Bureau of Reclamation, Boulder City, Nev.

McBrayer, Thomas Benson (Age 46) With Greenville Steel & Foundry Co., Greenville, S.C.

McCord, Max (Jun.) (Age 34) Maj., Corps of Engrs., U.S. Army, Phoebus, Va.

Megahed, Mohammed Mohammed (Age 33) Struct. Engr., Cummins & Barnard, Inc., Ann Arbor, Mich.

Morrison, James Edward (Age 46) City Engr. and Supt. of Utilities, Renton, Wash.; Seattle, Wash.

Narver, David Lee, Jr. (Jun.) (Age 28) Senior Struct. Engr., Holmes & Narver, San Marino, Calif.

Orr, Charles Ivan (Age 42) Des. Engr., Consolidated Western Steel Corp. & Consolidated Steel Corp., Los Angeles, Calif.

Osoffsky, Jake (Jun.) (Age 35) Engr., P-4, U.S. Bureau of Reclamation, Sacramento, Calif.

Pedersen, Gunnar Sverre (Age 32) Maj., Dist. Engr., Engr. Services of Norwegian Forces, Trondheim, Norway.

Perez Daple, Luis (Age 34) Post-graduate student, Civ. Eng. Course, Univ. of Utah, Salt Lake City, Utah.

Powers, George Black (Age 35) With The Chester Engineers, Pittsburgh, Pa.

Rathburn, Robert Edison (Jun.) (Age 34) Asst. Prof., Univ. of Colo., Boulder, Colo.

Robinson, Jesse Paul (Age 28) Asst. Civ. Engr., Long Beach City Engr's. Office, Long Beach, Calif.

Schadler, Frederic Karl (Age 48) Designer and Static Calculator, Light & Power Co., Cobast, São Paulo, Brazil.

Scott, Marion Boardman (Age 35) Asst. Prof., School of Civ. Eng. & Eng. Mechanics, Purdue Univ., Lafayette, Ind.

Shah, Chandulal Mulchand (Age 37) Executive Engr., Great Indian Peninsula Ry., Bombay, India.

Smith, Burton Dunham (Age 36) Sales Engr., Armco Drainage & Metal Products, Inc., Denver, Colo.

Staub, Edmond Jean (Age 30) Scientific Asst. and Engr., Henry Wild Surveying Instruments Co., Heerbrugg, Switzerland.

Stewart, Richard Walter (Age 33) Senior Engr., Jackson & Moreland, Cons. Engr., Boston, Mass.

Stone, Theron Burnham (Age 36) Res. Engr., Acting as Res. Engr. Inspector, State Highway Dept., Tacoma, Wash.

von Colditz, Herbert Ware (Jun.) (Age 31) Struct. Designer, John A. Blume, Struct. Engr., San Francisco, Calif.

Watters, Frank Fairchild (Jun.) (Age 35) Assoc. Utilities Engr., Calif. Public Utilities Comm. San Francisco, Calif.

Watts, Calvin Thomas (Age 35) Assoc. Prof. of Civ. Eng., La. Polytechnic Inst., Ruston, La.

White, Clarence (Age 45) Engr., P-4, Irrigation and Drainage, U.S. Bureau of Reclamation, Denver, Colo.

Willow, Robert Hayes (Age 46) Superv., Testing Materials Div., State Highway Dept., Phoenix, Ariz.

Yardley, Arthur John (Jun.) (Age 34) Res. Engr., Corps of Engrs., Dept. of Army, Providence (R.I.) V.A. Hospital; Cranston, R.I.

FOR JUNIOR

Cram, James Jacob (Age 32) Civ. Engr., P-2, Bureau of Reclamation, St. Francis, Kans.

Dahlgren, Sven Olaf (Age 31) Office Engr., Asst. Area Engr., Guy F. Atkinson Co.; J. A. Jones Constr. Co., No. Richland, Wash.

Gopalkrishna Murthy, Ivatury (Age 24) Engr. Superv., Public Works Dept., Govt. of Madras, Madras, India.

Greacen, John Stuart (Age 27) Asst. Gen. Engr., Lock Joint Pipe Co., East Orange, N.J.

Greger, Harold William (Age 33) Engr., Eng. Office, Clyde C. Kennedy, San Francisco, Calif.

Helm, Haden Horine (Age 28) Hydr. Engr., P-2, Corps of Engrs., Los Angeles, Calif.

Ingle, Edwin Ervin (Age 26) Struct. Engr., Libbey-Owens-Ford Glass Co., Toledo, Ohio.

Kennedy, Russell Jordan (Age 31) Graduate Student, State Univ. of Iowa, Iowa City, Iowa.

Kuziw, John Joseph (Age 27) Designer, Preload Corp., New York City; Bronx, N.Y.

Magnocavallo, John Hugo (Age 27) Draftsman, Constr. Dept., The Texas Co., New York City.

Narasimhan, Rajendram Krishnamachari (Age 28) 1946 to 1948 Tech. Asst., Roads Organization New Delhi, India; at present graduate student, Univ. of Mo.

O'Hara, Brendan Peter (Age 22) Asst. Engr. A. A. Johnson & Mason & Hanger, Inc., New York City.

Pranich, Kanok (Age 25) Asst. Engr., Tech. Office, Irrigation Dept., Bangkok, Siam; at present graduate student, Cornell Univ., Ithaca, N.Y.

(*Continued on page 94*)

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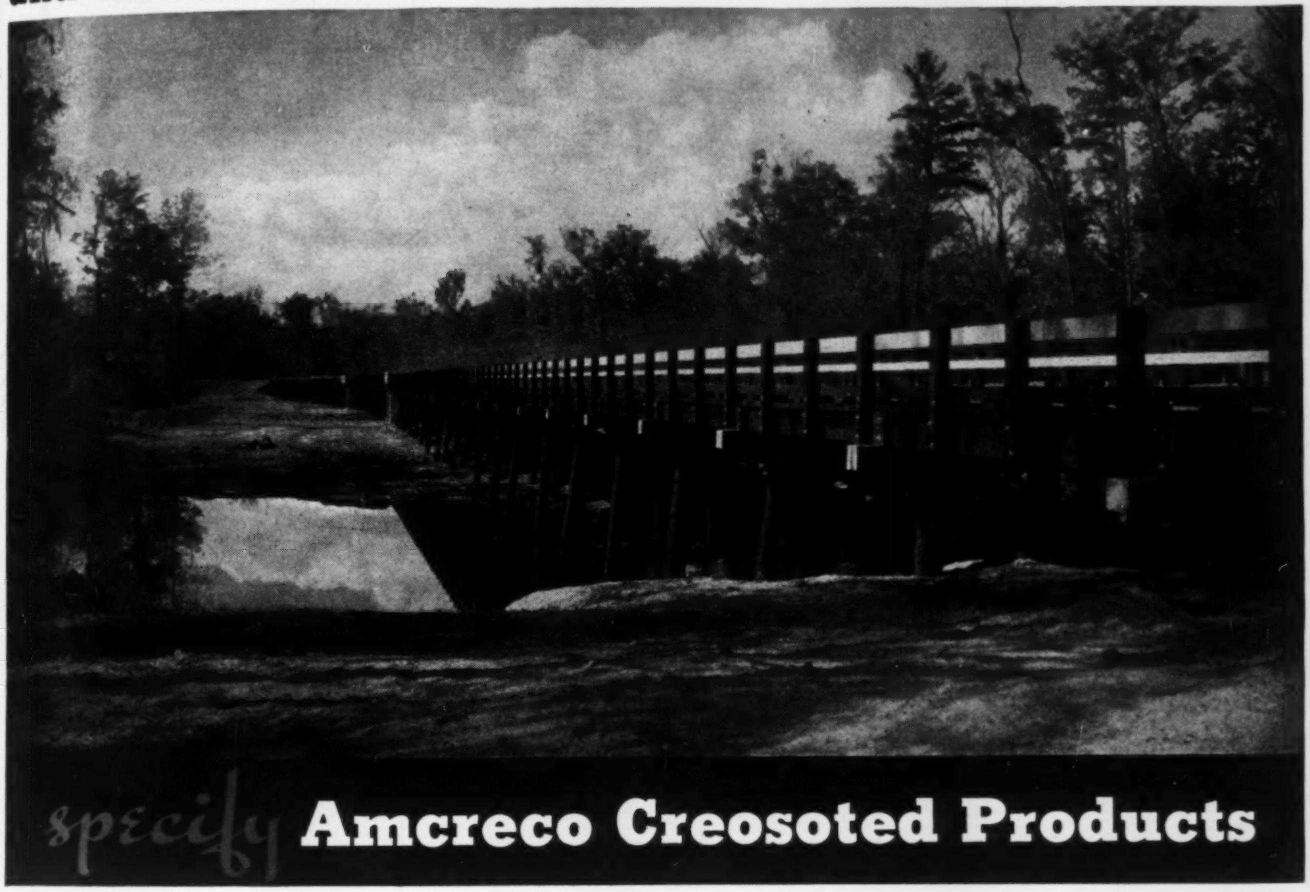

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(Continued from page 92)

Schmidt, Arthur Larry (Age 26) Engr., Irvington Concrete Form & Tank Co., New York City.

Tizard, William Irvin (Age 30) Struct. Engr., P-3, U.S. Bureau of Reclamation, Phoenix, Ariz.

UNIV. OF ALA.

	Age
Smith, Ralph Austin, Jr., 1948	(22)
Wolfe, Clyde, Jr., 1948	(27)

ALA. POL. INST.

Howell, William Malcolm, 1948	(26)

UNIV. OF ARK.

Walls, Worthen Allen, 1948	(26)

BROOKLYN POL. INST.

Romeo, Salvatore Joseph, 1948	(28)

BROWN UNIV.

Abrahams, Jacob, 1948	(22)

CARNEGIE INST. TECH.

Louis, Charles Richard, 1948	(28)
Neubert, Vernon Herbert, 1948	(20)

CASE INST. TECH.

Godley, Jo (Miss), 1948	(25)
Weissman, Franklyn Bernard, 1948	(25)

UNIV. OF CIN.

Whitehead, Robert Fred, 1948	(27)

THE CITADEL

Bailey, Ralph, Jr., 1948	(21)

CLARKSON COLL. TECH.

Bohlander, Frank Clifford, 1948	(22)
Clifford, Peter Christopher, 1948	(25)
Coakley, John Riley, 1948	(26)
Fimmano, Ralph Anthony C., 1948	(30)
Leopold, Vaughn Edward, 1948	(24)
Lockwood, Carleton Wallace, 1948	(26)
Peterson, Albert Erick, 1948	(24)
Smith, John Albert, 1948	(26)

CLEMSON A. & M.

Traylor, Marion Hartwell, Jr., 1948	(28)

COLUMBIA UNIV.

Kermit, Mark Lael, 1948	(27)
Tyson, Herbert I., 1948	(22)

UNIV. OF CONN.

White, Nathan Colman, 1948	(26)

CORNELL UNIV.

Liu, Annabel Lee (Mrs.), 1947	(26)

	Age
Macdonald, James Wear, Jr., 1948	(23)
Vorbeck P, Gonzalo Manuel, 1948	(21)

GA. SCHOOL TECH.

Beale, Luther Alton, 1948	(25)

UNIV. OF ILL.

Lopinot, Paul Leonard, 1947	(23)
St. Pierre, Alfred Joseph, 1948	(24)

IOWA STATE COLL.

Gayer, Richard Julius, 1948	(31)
Hennesy, Willard Dean, 1948	(22)

IOWA STATE UNIV.

Smith, Robert Lee, 1948	(25)

UNIV. OF KANS.

Montfort, John Gordon, 1948	(25)

UNIV. OF KY.

Nelson, Earl William, 1948	(25)

LEHIGH UNIV.

Fletcher, Herbert Ellery, II, 1948	(24)
Stan, Joseph Raymond, 1948	(30)

LA. STATE UNIV.

McNamara, Francis Paul, 1948	(24)

UNIV. OF MAINE

Chapman, Charles Vaughn, Jr., 1947	(27)

MARQUETTE UNIV.

Braam, Theodore Henry, 1948	(23)
Feldman, Gilbert Seymour, 1948	(22)
Fonda, Stewart Herrick, Jr., 1948	(23)
Hofstedt, John Herbert, 1948	(29)
Jaworski, Daniel Andrew, 1948	(23)
Klotz, Harold Earl, 1948	(26)
Skurski, Alexander Wallace, 1948	(27)
Spencer, Thomas Evans, 1948	(32)
Villa, Thomas Spencer, 1948	(22)
Voros, Thomas Louis, Jr., 1948	(22)

MASS. INST. TECH.

Kurz, Charles Richard, 1948	(24)
Snyder, Willard Monroe, 1948	(30)

UNIV. OF MICH.

Kassir, Matti Andria, 1948	(22)

UNIV. OF MINN.

Faust, William Croft, 1948	(26)
Jorgenson, Marilyn Ethel, 1948	(22)
McLean, Donald Hugh, 1947	(27)

MISS. STATE COLL.

Pratt, Edwin Berkley, 1947	(24)

UNIV. OF MISS.

	Age
Lewis, William Floyd, 1948	(31)
Smith, John Rittenberry, 1948	(24)

UNIV. OF NEV.

Canessa, William, 1948	(23)

COLL. OF CITY OF N.Y.

Cakouros, Steve Clarence, 1948	(25)
Cherry, Irving, 1948	(26)
Grossman, Walter Bernard, 1948	(21)
Kaufman, Harry, 1948	(26)
Milano, Daniel Dominick, 1948	(28)
Roet, Harold David, 1948	(21)
Senor, Gabriel, 1948	(24)
Sterling, Bowen, 1948	(27)

N. DAK. STATE COLL.

Johnson, Glenn Russell, 1948	(25)

UNIV. OF OKLA.

Bemis, Charles Seth, 1948	(30)

PA. STATE COLL.

McGilloway, James Thomas, 1948	(22)
Murphy, Raymond Chester, Jr., 1948	(22)

UNIV. OF PITTSBURGH

Wilstein, David, 1948	(20)

PURDUE UNIV.

Covault, Donald Orville, 1948	(22)
Kinnaman, John Franklin, II, 1948	(24)

RENS. POL. INST.

Rogers, Morgan Griswold, 1948	(23)

UNIV. OF SO. CALIF.

Ball, Delmore Thurlow, 1948	(24)
Howland, John Beeman, 1948	(25)
Till, Weston Kay, 1948	(24)

SYRACUSE UNIV.

Powers, Patrick, 1948	(29)

UNIV. OF TENN.

Eldridge, Winfield, Jr., 1948	(26)
Nagle, Paul Raymond, 1948	(26)
Pierce, George Burton, 1948	(25)
Singh, Harbans, 1948	(26)

TEX. A. & M. COLL.

Birkhead, William Glenn, 1948	(22)
Cortez, Alce Joseph, Jr., 1948	(25)
Justiss, Thomas Shelby, Jr., 1948	(22)
Kelly, James Edward, 1948	(24)
Wilson, Paul Clark, Jr., 1948	(21)

UNIV. OF TEX.

Badgett, Joe Schley, 1948	(25)
Bernard, Francis Patrick, 1948	(26)
Burgin, Marvin Dickson, 1948	(23)
Finklea, Irving Carroll, 1948	(27)
Fischer, Stewart Clarence, 1948	(24)
Folk, William Custer, 1948	(31)
Hood, Herred Mack, 1948	(27)
McDonald, Billy Bob, 1948	(23)
Nance, Elbert Sidney, 1948	(27)
Ossa-Orsini, Victor Manuel, 1948	(23)
Pitstick, William James, 1948	(25)
Thompson, Albert Theodore, Jr., 1948	(30)

WASH. STATE COLL.

Fenton, John Gordon, 1948	(23)

UNIV. OF WASH.

Barnes, James Anthony, 1948	(21)
Finke, Bruce Gordon, 1948	(22)
Gillis, Lester James, 1948	(27)
Miller, Jefferson Pugh, 1948	(26)
Orlob, Gerald Thorvald, 1948	(24)
Saxton, Walter Wayne, 1948	(25)
Smallwood, Herbert Alfred, 1948	(28)

WORCESTER POL. INST.

George, David Batcombe, 1948	(27)

YALE UNIV.

Wright, Victor Hugo, Jr., 1948	(26)

Louis Joseph Capozzoli received his master's degree from Harvard Univ. in 1948, instead of from N. Y. Univ., as was inadvertently stated in the October 1948 issue.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

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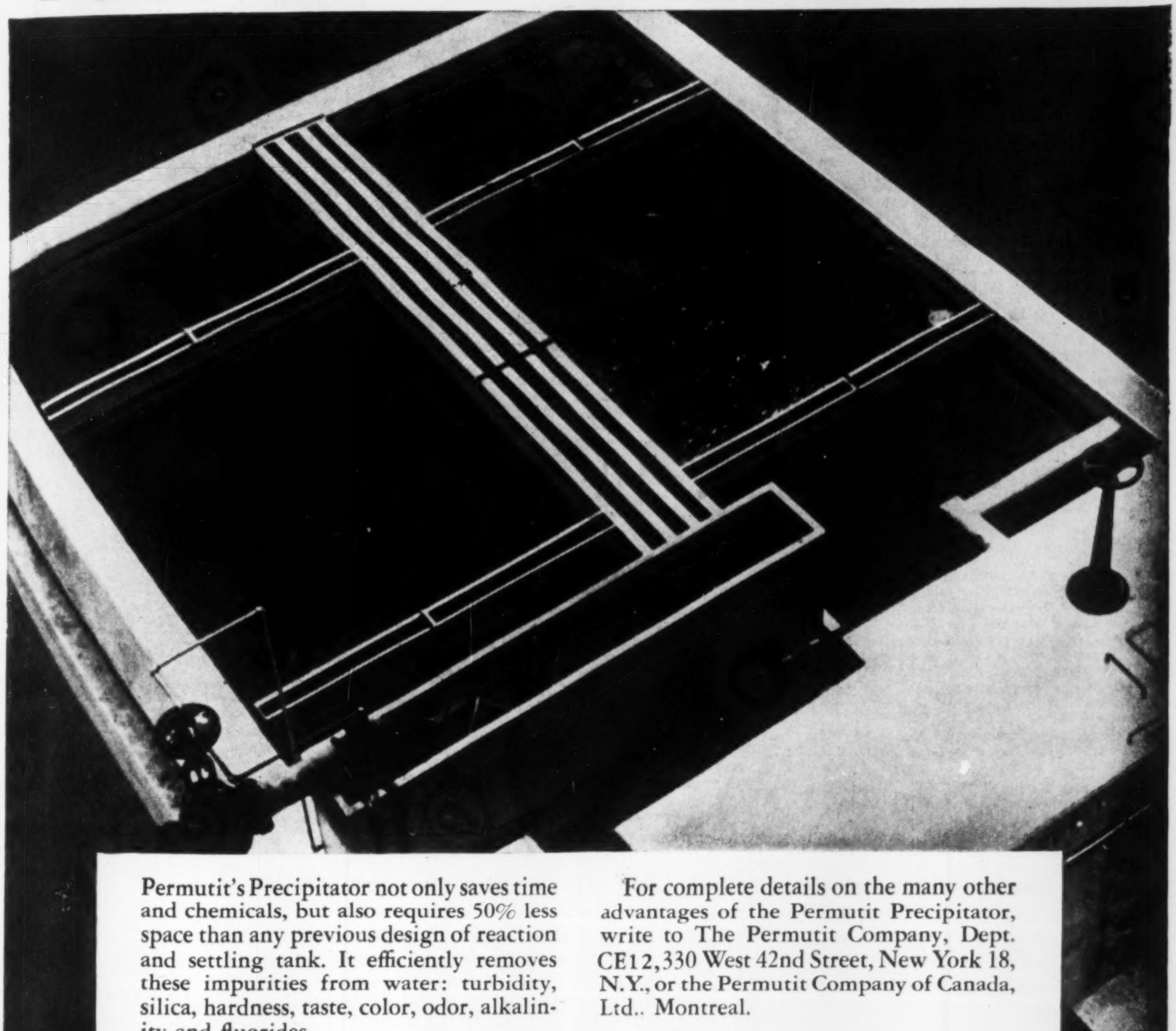

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CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From October 10 to November 9, 1948

Additions to Membership

Albert, Alfred William (Jun. '48) San. Engr., Weston & Sampson, Boston (Res., 7 Stone Ave., Egypt), Mass.

Aluise, Robert Richard (Assoc. M. '48) Archt. Engr., War Dept., U.S. Army, Office Chief Engrs., Washington, D.C. (Res., 230 Maple Ave., Takoma Park, Md.)

Anderson, Earl Leo (Jun. '48) Constr. Engr., Cunningham-Reis Co., 421 Liberty Bldg., Des Moines, Iowa.

Anderson, Richard Martin (Jun. '48) Junior Petroleum Engr., Stanolind Oil & Gas Co., Star Route, Odessa, Tex.

Appel, Daniel Joseph (Jun. '48) Bar Detailer and Draftsman, Moccia-Driscoll Constr. Corp. (Res., 929 Duncan St.), New York, N.Y.

Artuso, Joseph Frank (Jun. '48) Civ. Engr., Patterson Constr. Co., Tenth St., Monongahela (Res., 964 Thompson Ave., Donora), Pa.

Ayala-Duarte, Francisco Antonio (Assoc. M. '48) Engr., Instituto Nacional de Obras Sanitarias Mercedes a Mijares 33, Caracas (Res., Calle El Carman 7, Dos Caminos Edo. Miranda), Venezuela.

Beach, Carter Leroy (Jun. '48) Field Engr., Blaw-Knox Constr. Co., 321 Penn Ave., Pittsburgh, Pa. (Res., 440 Center St., Coloma, Mich.)

Bentley, Harold Roy (Assoc. M. '48) 285 Frieda Ave., Kirkwood, Mo.

Bingham, Andrew Thomson (Jun. '48) Junior Engr., Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B.C., Canada.

Blair, James Philip (Jun. '48) Field Engr., Roberts & Schaefer Co. (Res., Box 30), Decota, W.Va.

Blomquist, Paul Erland (Assoc. M. '48) Asst. Civ. Engr., Board of Water Supply, City of New York (Res., 22 No. Main St.), Ellenville, N.Y.

Bolton, John Merrill, Jr. (Jun. '48) Junior San. Engr., Bureau of Sanitation, State of Ala., 300 Dexter Ave., Montgomery, Ala.

Bowers, Edwin Ralph (Jun. '48) Junior Engr., Va. Gas Transmission Corp., P.O. Box 1152 (Res., P.O. Box 682), Lexington, Va.

Boxer, Herman (Jun. '48) Junior Civ. Engr., Triborough Bridge & Tunnel Authority (Res., 2857 Barker Ave.), New York, N.Y.

Breitkreutz, Emil William (M. '48) Asst. Engr., Water Distribution, City of Los Angeles (Res 1404 Wilson Ave., San Marino), Calif.

Brewer, John Augustus (Assoc. M. '48) City Engr., City of Neodesha (Res., 623 No. 8th St.), Neodesha, Kans.

Broselow, Robert Owen (Jun. '48) Research Asst., Princeton Univ. (Res., 2 Dickinson St.), Princeton, N.J.

Brown, Chandler Wilcox (Jun. '48) Instr.. Duke Univ., College of Eng., Durham, N.C.

Burke, Thomas Frederick (Jun. '48) Engr., Phillips Petroleum Co., Bartlesville, Okla. (Res., 4411 Rosalie, St. Louis, Mo.)

Burzenski, Anthony Peter (Assoc. M. '48) Asst. Civ. and Struct. Engr., Drake Puget Sound, 2801 Sixteenth S.W., Seattle (Res., 2221 Ninth Pl., Renton), Wash.

Campbell, Frank Whitney (Jun. '48) Gen. Engr., Vilbig Bros., Inc., Singleton Bldg. (Res., 4519 Westway), Dallas, Tex.

Campbell, James Elbert, Jr. (Jun. '48) Struct. Engr., Fischer Steel Corp., 206 Walnut, Memphis (Res., 1720 Main St., Humboldt), Tenn.

Canada, Rayford Reed (Jun. '48) Designer and Detailer, 2143 Lea Crest Dr., Dallas, Tex.

Cappel, Roy Glenn (Jun. '48) Engr., W. Horace Williams Co., 833 Howard Ave., New Orleans, La.

Casebolt, George Clifford (Jun. '48) Instrumentman, Milwaukee R.R., Tacoma (Res., Route 2, Box 745, Auburn), Wash.

Churton, Paul Mackintosh (Jun. '48) Engr., Andersons' Inc., 1500 Pennsylvania Ave., Charleston, W.Va.

Clapp, Prescott Jones (M. '48) Senior Section Engr., Board of Water Supply, City of New York, Ellenville (Res., 320 Lucas Ave., Kingston), N.Y.

Clark, George William (Jun. '48) Engr. on Constr. Work, Southern Bldgs., Inc., Tallahassee (Res., P.O. Box 48, Perry), Fla.

Clem, Donald Worthington (Jun. '48) Junior Asst. Bridge Engr., Grade II, Md. State Roads Comm., Bridge Dept., Tower Bldg., Baltimore (Res., 17-F Parkway Rd., Greenbelt), Md.

Cockerham, Charles E. (Jun. '48) Civ. Engr., Deluca Constr. Co., 1055 Grant St. (Res., 388 Raasch Ave.), Akron, Ohio.

Cohen, Herbert Warren (Jun. '48) 42 Nevada St., Winthrop, Mass.

Collins, Thomas Wellington (Jun. '48) Junior Civ. Engr., Dept. of Public Works, Court House (Res., 844 Hague Ave.), St. Paul., Minn.

Colony, David Carl, Jr. (Jun. '48) Junior Engr., Wickersham & Chance, Naval Archts., 804 17th St., N.W., Washington, D.C. (Res., 4312 Kaywood Dr., Apt. 2, Mt. Rainier, Md.)

Comstock, Frederick Theodore, Jr. (Jun. '48) Junior Engr., State Highway Dept., Concord, N.H.

Cornett, Jack Burke (Jun. '48) Struct. Des. Engr., War Dept., U.S. Corps of Engrs., Govt. Air Plant No. 3 (Res., 7136 East 4th Pl.), Tulsa Okla.

Costello, Frank (Assoc. M. '48) Asst. Civ. Engr., N.Y. Board of Water Supply, New York (Res., 5 Center St., Ellenville), N.Y.

Cota, John Francis (Jun. '48) Cadet Engr., Iowa Power & Light Co., 312 6th Ave. (Res., 1414 19th St.), Des Moines, Iowa.

Craig, Charles Fremont (Jun. '48) Reinforcing Steel Detailer, Mercer Steel Co., 2555 N.W. Nicaloi (Res., 3125 S.E. Lincoln), Portland, Ore.

Crane, Robert John (M. '48) Asst. Chf. Engr., N.Y. Central R.R. Co., New York (Res., 1 Leighton Ave., Yonkers), N.Y.

Creighton, David Edward, Jr. (Jun. '48) Civ. Engr., U.S. Bureau of Reclamation, Design & Constr. Branch (Res., Route 7, Box 1149), Sacramento), Calif.

Crossett, Christopher William (Jun. '48) Proj. Engr., du Pont, Independence Rd., Cleveland (Res., 13404 2d Ave., East Cleveland), Ohio.

Crouch, Jacob Elmo (Assoc. M. '48) Asst. Office Engr., U.S. Engrs., P.O. Box 915, Augusta, Ga.

Cummins, Donald Kenneth (Jun. '48) Graduate Student, Univ. of Mich., Ann Arbor (Res., 335 Ashland Ave., Detroit), Mich.

Cutting, Charles Lewis (Jun. '48) Junior Engr., Sverdrup & Parcel, Inc. (Res., 3905 Clay St.), San Francisco, Calif.

Datta, Ravi (Assoc. M. '48) Project Planning & Dams Design Div., Maradabad, U.P., India.

Davis, George Parker (Assoc. M. '48) Res. Engr., U.S. Engr. Dept., Corps of Engrs., Yuma Test Branch, P.O. 1791, Yuma, Ariz.

Davis, Russell Lathrop (Jun. '48) Junior Civ. Engr., Calif. State Div. of Highways, Los Angeles (Res., 2075 No. El Molino, Altadena), Calif.

Dawyot, Joseph Thomas (Jun. '48) Struct. Engr., National Advisory Comm. on Aeronautics, Structures Div., Langley Field (Res., 224 Regent St., Hampton), Va.

Deaderick, William Franklin (Assoc. M. '48) Dist. Engr., State Highway Comm., Wynne (Res., 400 East Main St., Marianna), Ark.

De Armond, Charles (Jun. '48) Warren, Ark.

Degen, Jerome (Jun. '48) Asst. to City Engr., City Engineer's Office, Care, City Hall (Res., 712 S. Catalpa), Pittsburgh, Kans.

De Hamel, John Belleau, Jr. (Jun. '48) Engr.-in-Training, The George S. Rider Co., 3800 Terminal Tower (Res., 9610 Lamont Ave.), Cleveland, Ohio.

Del Burgo, John (Jun. '48) Sanitarian, Washtenaw County Health Dept., 720 Catherine St., Ann Arbor, Mich.

Delgado, Arturo (Jun. '48) Graduate Student, Princeton Univ., 126 Graduate College, Princeton, N.J.

Dembo, Michael (Jun. '48) Civ. Engr., Jackson & Moreland, Engrs., 600 Park Sq. Bldg. (Res., 36 St. Stephens St.), Boston, Mass.

Dempsey, John Marion (Jun. '48) Computer-draftsman, Michael Baker, Jr., Inc. (Res., 201 West Waldburg), Savannah, Ga.

Dodson, John Robert (Jun. '48) (Res., Latero, Tex.)

Donnell, Harland Holmes (Assoc. M. '48) Engr., Jackson & Moreland, Boston (Res., 42 Norwood St., Sharon), Mass.

Dugan, Harold Herbert, Jr. (Jun. '48) Junior Engr., Toledo Edison Co. (Res., 2127 Potomac Dr.), Toledo, Ohio.

Duggan, Francis Joseph (M. '48) Asst. Civ. Engr., Board of Water Supply, City of New York, Church & Warren Sts. (Res., 43 Center St.), Ellenville, N.Y.

Dukehart, Russell Evan (Jun. '48) Junior Asst. Highway Engr., State Roads Comm., Baltimore (Res., 413 Woodbine Ave., Towson), Md.

Eby, Robert Earl (Jun. '48) Asst. Technical Service, West Coast Lumbermens Association, 1410 S.W. Morrison (Res., 7734 S.E. 36th St.), Portland, Ore.

Edwards, Carl Milton (Jun. '48) Estimator, C. M. Barr, Gen. Contr., 218 So. Grant Ave. (Res., 162 East 12th Ave.), Columbus, Ohio.

Edwards, Ray Omer (M. '48) Executive Director, Housing Authority of Jacksonville, 3550 Brentwood Ave. (Res., 934 Sorrento Rd.), Jacksonville, Fla.

Eligator, Morton Herbert (Jun. '48) Junior Draftsman & Engr., Moccia-Driscoll Constr. Co., 41 East 42d St., New York (Res., 104-73 113 St., Richmond Hill), N.Y.

Elliott, Kenneth Richardson, (Jun. '48) Engr. Inspector II, State Highway Dept., Keytesville (Res., Keytesville), Mo.

Erdman, Paul Bryant (Jun. '48) Engr.-in-Training, Modjeski & Masters, Cons. Engrs., State St. Bldg. (Res., 2003 No. Second St.), Harrisburg, Pa.

Ettelman, Benjamin (M. '48) Civ. Engr., City of New York, Board of Water Supply (Res., 247 Wadsworth Ave.), New York, N.Y.

Evans, Karl Held (Assoc. M. '48) Asst. Prof., Univ. of Mo., 148 Eng. Bldg., Columbia, Mo.

Ezra, Arthur Abraham Hyam (Jun. '48) Draftsman, International Eng. Co., 1 Montgomery St., San Francisco (Res., 1959 Napa Ave., Berkeley), Calif.

Farr, Leo Grant, Jr. (Jun. '48) Junior Civ. Engr., State Dept. Public Works, Div. of Archt., San. Section, 23rd & R Sts., Sacramento, Calif. (Res., Box 55, Clackamas, Ore.)

Fox, Robert Clark (Jun. '48) Struct. Engr., Macomber, Inc., 612 15th St., N.W., Canton, Ohio.

Frank, Edward Thomas (Jun. '48) Transitman, Lehigh Valley R.R., Jersey City (Res., 21 Windsor Ave., East Rutherford), N.J.

Garrison, John Carl, Jr. (Jun. '48) Struct. Engr., Timber Eng. Co., 1319 Eighteenth St. N.W., Washington, D.C.

Gary, Joseph S. (Jun. '48) Civ. Engr., American Bridge Co., Ambridge (Res., 5800 Wellesley Ave., Pittsburgh), Pa.

Gaspari, Donald Joseph (Jun. '48) Junior Civ. Engr., M. W. Kellogg Co., 225 Broadway, New York (Res., 2686 Briggs Ave., Bronx), N.Y.

Gervais, John Lewis, Jr. (Jun. '48) Struct. Detailer, American Bridge Co., Gary, Ind. (Res. Johns Island, S.C.)

(*Continued on page 99*)

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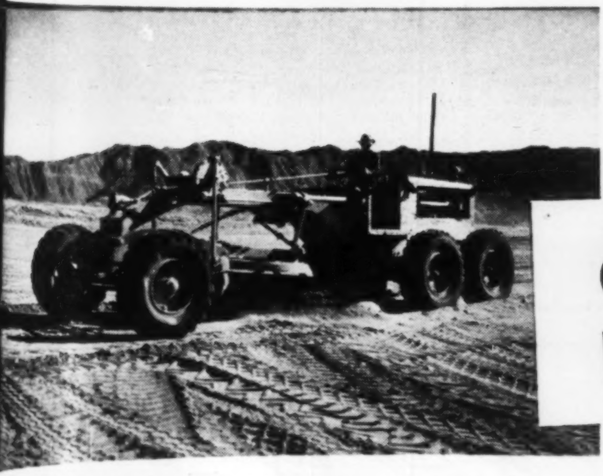

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Assistant Hydraulic Engineer, preferably with engineering degree. Must have had three years' experience in design, construction or operation of water-works systems, preferably two years with a regulatory commission. Working knowledge of accounting desired. Duties will include examination and inspection of privately owned water-works systems. Examination and reports as to whether water-works systems can carry additional loads occasioned by increased demand of industries. Occasional traveling within New York State. Salary, to start, $4,242 plus expenses. Location, New York, N.Y. Y-1417.

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Dean of Engineering, civil graduate, with Doctor's degree and at least 10 years' professorial experience, including heavy construction, hydraulics, irrigation, etc., to assume complete executive responsibility of engineering school. Salary, $6,000–$7,500 a year. Location, West. Y-1498S.

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(*Continued on page 99*)

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(Continued from page 98)

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Engineers. (*a*) Assistant Construction Superintendent, with at least 10 years' contracting experience covering industrial plant utilities, road, etc. Salary, $10,200–$11,400 a year. (*b*) Personnel Manager with at least 5-years' experience in personnel work in construction industry. Salary, $7,800–$9,000 a year. Location, England. Y-1774.

Mechanical or Civil Engineers, preferably experienced in pump and paper mills, but general construction experience on industrial buildings and installation of heavy machinery such as chemical plant equipment will be considered. Positions involve the field end of construction work on planning, scheduling, and expediting of the projects; including checking on work progress, field efficiency, etc. Salary, up to $4,500 a year, depending upon qualifications. Location, Maine. Y-1783.

Changes in Membership Grades

(*Continued from page 96*)

Giuliano, Carmine Frank (Jun. '48) Junior Civ. Engr., East Bay Municipal Utility Dist., 525 19th St., Oakland (Res., 16550 East 14th St., San Leandro), Calif.

Glass, Elliott Marlow (Jun. '48) Engr., P-1, U.S. Corps of Engrs., Tulsa Dist., P.O. Box 61 (Res., 229 East Queen), Tulsa, Okla.

Goldemberg, Jamie (Jun. '48) Instr., Civ. Eng. Dept., Seattle Univ., 900 Broadway, Seattle, Wash.

Gollub, Stanley (Jun. '48) Engr., Neal J. Campbell, 911 Locust, St. Louis (Res., 7308 Chamberlain, University City), Mo.

Goodrich, Robert Milton, Jr. (Jun. '48) Estimator, Robert F. Hyland & Sons, Inc., 375 Averill Ave., Rochester, N.Y.

Gordon, Ruth Vida (Jun. '48) (Res., 1947 3rd Ave. West, Seattle, Wash.)

Granley, Edwin Calver (Jun. '48) P-1 Highway Engr., Public Roads Administration, Detroit, Ore.

Greiner, Albert William (Assoc. M. '48) Assoc. Constr. Engr., State Highway Comm. (Res., 1034 Butte Ave.), Helena, Mont.

Gumpertz, Werner Herbert (Assoc. M. '48) Engr., United Engrs. & Constrs., Inc., 1401 Arch St. (Res., 228 So. 46th St.), Philadelphia, Pa.

Halvorson, Raymond Otto (Jun. '48) Civ. Engr., Tacoma City Light, 312 City Hall Annex (Res., 3144 So. 17th), Tacoma, Wash.

Haney, Lewis C. (Jun. '48) Archt. Engr., Phillips Petroleum Co. (Res., 713 Shawnee Ave.), Bartlesville, Okla.

Harra, Joseph Shirley (Jun. '48) Salesman-in-Training, Florida Div., General Portland Cement Co., Stovall Professional Bldg. (Res., 1301 Morrison Ave.), Tampa, Fla.

Harris, George Walter (Jun. '48) Struct. Engr., Harris Structural Steel Co., Inc. (Res., 700 Sherman Ave.), Plainfield, N.J.

Hartman, Harry Franklin (M. '48) Head, Eng. Div., Humble Oil & Refining Co., P.O. Box 3292 Baytown, Tex.

Hatch, Robert Alan (Jun. '48) Junior Engr., The Fluor Corp., Ltd., 2500 So. Atlantic (Res., 409 So. Manhattan Pl.), Los Angeles, Calif.

Hausmann, Delbert Arthur (Jun. '48) Junior Civ. Engr., State Div. of Water Resources, Room 803, Calif. State Bldg., Los Angeles (Res., 728 Cordova Ave., Glendale), Calif.

Helthall, Stuart Robert (Jun. '48) Asst. Civ. Engr., Lock Joint Pipe Co., East Orange (Res., 57 Briarcliff Rd., Mt. Lakes), N.J.

Herman, George Jacob (Jun. '48) Instr., Bucknell Univ., Box 467, Lewisburg, Pa.

Hert, Oral Howard (Jun. '48) Public Health Trainee 1, State Board of Health, 1098 West Michigan St. (Res., 358 So. Audubon Rd.), Indianapolis, Ind.

Higgins, George Richardson (Jun. '48) Junior Hydr. Engr., U.S. Geological Survey, W. R. Branch, 939 Post Office Bldg., Boston, Mass. (Res., R.F.D. 2, Meredith, N.H.)

Himebaugh, Paul Harold (Jun. '48) Draftsman, Sverdrup & Parcel, Inc., 1118 Syndicate Trust Bldg., St. Louis (Res., 7823 Grove Ave., Webster Groves), Mo.

Hodel, Leslie Earl (Jun. '48) Struct. Draftsman, Portland General Electric Co., 621 S.W. Alder St. (Res., 305 S.W. Montgomery St.), Portland, Ore.

Hodges, Dan Allen (Assoc. M. '48) Engr., Mark K. Wilson Co., Chamberlain Bldg. (Res., 3122 Rose Terrace), Chattanooga, Tenn.

Hoffman, Jerome Jay (Jun. '48) Coordinating Engr., J. & M. Hoffman Corp., 1160 Utica Ave., Brooklyn, N.Y.

Holley, Carl Albert (Jun. '48) Junior Engr., W. C. Kruger & Associates (Res., 570 R St.), Los Alamos, N.Mex.

Holmquist, Lars (Jun. '48) Draftsman, American Bridge Co. (Res., 370 Monroe St.), Gary, Ind.

Horner, Stephen (Jun. '48) Job Clerk, Wm. L. Blanchard Co., Newark (Res., 6 Westview Rd., West Orange), N.J.

Hughes, George Farant, Jr. (Jun. '48) 1507 Lexington Ave., Roanoke, Va.

Hurd, Richard Merritt (Jun. '48) Looper, Bethlehem Steel Co., Lackawanna (Res., 158 Choate Ave., Buffalo), N.Y.

Hutchison, Sylvanus Nye (Assoc. M. '48) Res. Engr., Chesapeake & Ohio Rwy. Co., Pikeville, Ky. (Res., 339 Sixth Ave., Huntington, W.Va.)

Inwald, Martin (Jun. '48) Junior Civ. Engr., New York City Transit System, 2545 7th Ave., New York (Res., 680 Lefferts Ave., Brooklyn), N.Y.

Jacobsen, Ted Barry (Jun. '48) Constr. Supt., Raymond Concrete Pile Co., 140 Cedar St., New York, N.Y. (Res., 1 English Village, Cranford, N.J.)

Jeske, Richard John (Jun. '48) Struct. Des. Engr., Austin Co., 450 First Ave., Roselle (Res., 209 Benson Pl., Westfield), N.J.

Johnson, Charles Sidney, Jr. (Jun. '48) Struct. Detailer, Mo. Pacific R.R., 13th & Olive, St. Louis, Mo.

Johnson, Philip Ellis (Jun. '48) Graduate Student, Teaching Asst., Univ. of Calif. (Res., International House), Berkeley 4, Calif.

Johnson, Wendell Arthur (Assoc. M. '48) Struct. Engr., Simon & Boulware, Philadelphia, Pa. (Res., 2946 Cramer St., Camden, N.J.)

Jones, Edwin Lee, Jr. (Jun. '48) Supt. Engr., J. A. Jones Constr. Co., Inc., Charlotte (Res., 102 East Lavender St., Durham), N.C.

Jones, Kenneth Rowland (Jun. '48) Section Asst. (Student), Univ. of Calif., Civ. Eng. Dept., Berkeley (Res., 5245 Knott Blvd. ID., Richmond), Calif.

Jones, Kenneth Warren (Jun. '48) Asst. Engr., Larsen Constr. & Eng. Co., 2667 Lincoln Ave. (Res., 556 23rd St.), Ogden, Utah.

Kahn, David (Jun. '48) Struct. Steel Designer, Madigan-Hyland, Long Island City (Res., 3028 West 23rd St., Brooklyn), N.Y.

Kemp, Clarence William (Jun. '48) 164½ 13th East, Salt Lake City, Utah.

Kindl, Robert Joseph (Jun. '48) Struct. Designer, Rust Eng. Co. (Res., 131 Sheridan Ave., Bellevue), Pittsburgh, Pa.

Kling, Gerald John (Jun. '48) Research Assoc., Soil Mechanics, Harvard Univ., Graduate School of Eng., Pierce Hall, Cambridge, Mass.

Knickerbocker, Hugh Irwin (Jun. '48) Student Engr., Standard Oil Development Co., Linden (Res., 18 Palisade Rd., Elizabeth), N.J.

Kornman, Lewis Hudson (Jun. '48) Field Engr., Kornman Constr. Co., 802 West 3rd St., Sterling, Ill.

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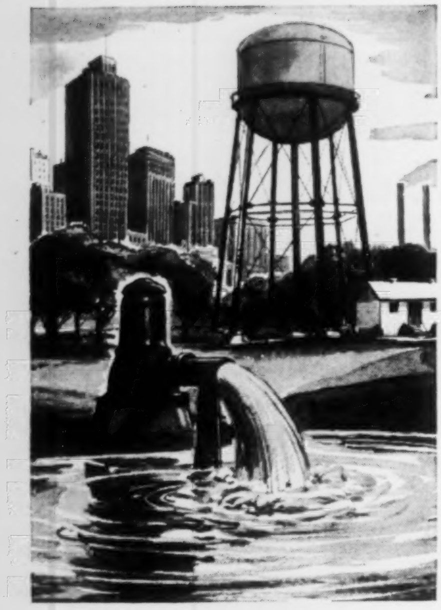

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Corporate Members	16,491
Honorary Members	43
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Affiliates	73
Fellows	1
Total	24,429
November 10, 1947	22,061

of Water Supply, City of New York, Box 30, Downsville, N.Y.

Krusling, James Ralph (Jun. '48) Junior Civ. Engr., Eng. Div. of City of Cincinnati, City Hall, 9th & Central (Res., 523 East Liberty St.), Cincinnati, Ohio.

Kugler, Donald William (Assoc. M. '48) Supervisor, Plant Eng. Section, Hughes Tool Co., 30 Hughes St., Houston, Tex.

Lacey, Robert Ray, Jr. (Jun. '48) Eng. Draftsman, James Atcheson, A.I.A., Sanford Bldg. (Res., 1625 Broadway), Lubbock, Tex.

Laks, Edward Edmund (Jun. '48) 1234 Rushing Rd., Shanghai, China.

Lal, Musaddi (Assoc. M. '48) Executive Engr. I Div., P.H.D. Meerut, Public Health Dept., United Provinces, India.

Leaver, Harvey Beers (Jun. '48) Office Engr., Armco Drainage & Metal Production Inc., 320 East 15th St., Topeka, Kans.

Lemcoe, Eli (Jun. '48) Struct. Engr., Sverdrup & Parcel, Inc., 915 Olive (Res., 1414 Semple), St. Louis, Mo.

Levine, George (Jun. '48) (Res., 1815 Blvd., New Haven, Conn.)

Lewis, Dudley Joseph (Assoc. M. '48) Dist. Civ. Engr., Humble Oil & Refining Co., P.O. Box 565, Freeport, Tex.

Lewis, Robert Milton (Jun. '48) Asst. Engr., National Board of Fire Underwriters, 85 John St., New York (Res., 3303 Richmond Rd., Staten Island 6), N.Y.

Lindquist, Fred Henry (Jun. '48) Senior Draftsman, Jackson & Moreland, Engrs., Park Sq. Bldg., Boston (Res., 765 Warren Ave., Brockton), Mass.

Linstrom, Vernie Glen, Jr. (Jun. '48) Civ. Engr., The Francis Eng. Co., 218 Cutler Bldg. (Res., 1308 Blaisdell St.), Rockford, Ill.

Logan, Jac (Jun. '48) Engr., Keyes Tank & Supply Co., Box 479, Casper, Wyo.

Lo Guidice, Frank Carmine (Jun. '48) Struct. Designer, Kellex Corp., 2 Lafayette St., New York (Res., 1649 78th St., Brooklyn), N.Y.

Long, Huntley Francis (Jun. '48) Junior Engr., Pennsylvania R.R., 444 East Court St., Cincinnati, Ohio (Res., 528 Oakwood, Webster Groves, Mo.)

Loughborough, Stuart Dickerson (Jun. '48) Apprentice Estimator, Conquest, Moncure, & Dunn, Inc., 208 East Cary St. (Res., Box 335 Route 9), Richmond, Va.

Luedtke, Norris Eric (Jun. '48) Res. Engr., Harold Hoskins & Associates, 231 No. 11th, Lincoln, Nebr.

MacDonald, Duncan Woolford (Jun. '48) Junior Civ. Engr., Board of Transportation, City of New York (Res., 35 Clark St.), Brooklyn, N.Y.

McCall, Warren Burton (Jun. '48) Archt. & Business Administrator, Tresler-McCall & Associates, Archts.-Engrs., 1105 Eleventh St., Cody, Wyo.

McClees, Thomas Atwood (Jun. '48) Draftsman, Jackson & Moreland, Engrs., 600 Park Sq. Bldg., Boston (Res., 39 Claymoss Rd., Brighton 35), Mass.

McCormick, Francis Miller (Jun. '48) Field Engr., J. E. Sirrine Co., Box 124, Childersburg, Ala.

McDonald, Jimmy Glen (Jun. '48) Struct. Engr., The Ballinger Co., 121 No. Broad St. (Res., 148 West Hansberry St.), Philadelphia, Pa.

McLaurin, Banks, Jr. (Jun. '48) Civ. Engr., Humble Oil & Refining Co. Box 672 (Res., 325 East Ragland), Kingsville, Tex.

Mandel, Herbert Maurice (Jun. '48) Graduate Student, Dept. of Civ. Eng., Yale Univ. (Res., 483 Orange St.), New Haven, Conn.

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Schriever, William Robert (Jun. '48) Dipl. Ing. ETH (Zurich), M.S. (Harvard), National Research Council, Div. of Bldg. Research (Res., 374 Driveway), Ottawa, Ont., Canada.

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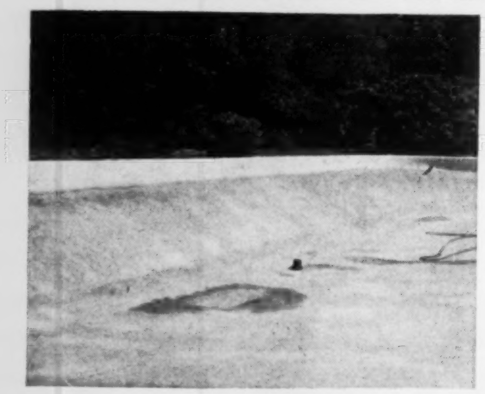

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Young, Robert Paul (Jun. '48) Maj., Corps of Engrs., Dept. of Army, Sandia Base, Albuquerque, N.Mex.

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Barbeau, Lionel Marcel (Jun. '45; Assoc. M. '48) Civ. Engr., U.S. Engr. Dept., U.S. Engineer Office (Res., 314 8th St.), Riverdale, N.Dak.

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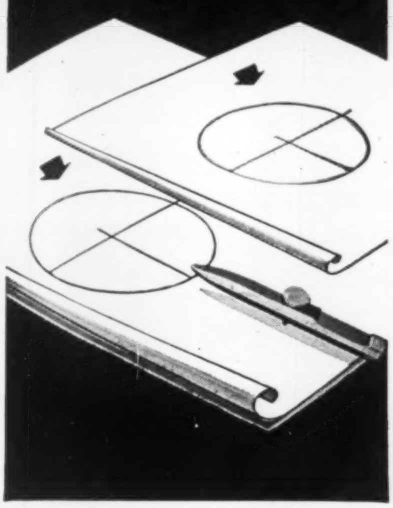

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Wilson, James Malcolm (Jun. '43; Assoc. M. '48) Designer, Black & Veatch, 4706 Broadway, Kansas City, Mo. (Res., 5314 Riggs Rd., Overland Park, Kans.)

Reinstatements

Baker, Thomas Wallace, Assoc. M., Dist. Mgr. and Asst. to Vice-Pres., American Locker Co., Inc., 202 Terminal Sales Bldg., Portland, Ore., reinstated Nov. 1, 1948.

Christina, Carlos Joseph, Jun., 1739 No. Dupre St., New Orleans, La., reinstated Sept. 29, 1948.

Cooper, Ralph Walker, Jr., Assoc. M., Lt. Col., Coast Artillery Corps, U.S.A., State Quartermaster, State Arsenal, St. Augustine, Fla., reinstated Oct. 21, 1948.

Lord Roy Stanley, Assoc. M., 4433 Albert St., Oakland, Calif., reinstated Sept. 22, 1948.

MacFarland, Lester Burton, Assoc. M., Park Dr., P.O. Box 213, Westfield, Mass., reinstated Oct. 11, 1948.

Pine, Edward Leonard, Assoc. M., P.O. Box 406, Reno, Nev., reinstated Sept. 24, 1948.

Remsen, Peter, Assoc. M., 7332 Piney Branch Rd., Takoma Park, Md., reinstated Sept. 29, 1948.

Rodenbaugh, Henry Nathan, M., Seven Pines, Elbow Lane, Haverford, Pa., reinstated Oct. 21, 1948.

Tayman, Arthur William, Assoc. M., County Engr., 2711 Cheverly Ave., Cheverly, Md., reinstated Sept. 29, 1948.

Tinnon, Frank Robertson, Jun. (Moncrief & Tinnon Lumber Co.), Goodlettsville, Tenn., reinstated Oct. 11, 1948.

Resignations

Bender, Homer Charles, M., 921 East 19th St. Spokane, Wash., resigned Oct. 27, 1948.

Emery, Frank Edward, M., 636 Clark St., Westfield, N.J., resigned Oct. 25, 1948.

Hill, Edgar Goodspeed, M., Vice-Pres., Ford, Bacon & Davis, Inc., 39 Broadway, New York, N.Y., resigned Sept. 30, 1948.

Lingo, Robert Myron, Jun., 625 Wayne Ave., Topeka, Kans. resigned Oct. 25, 1948.

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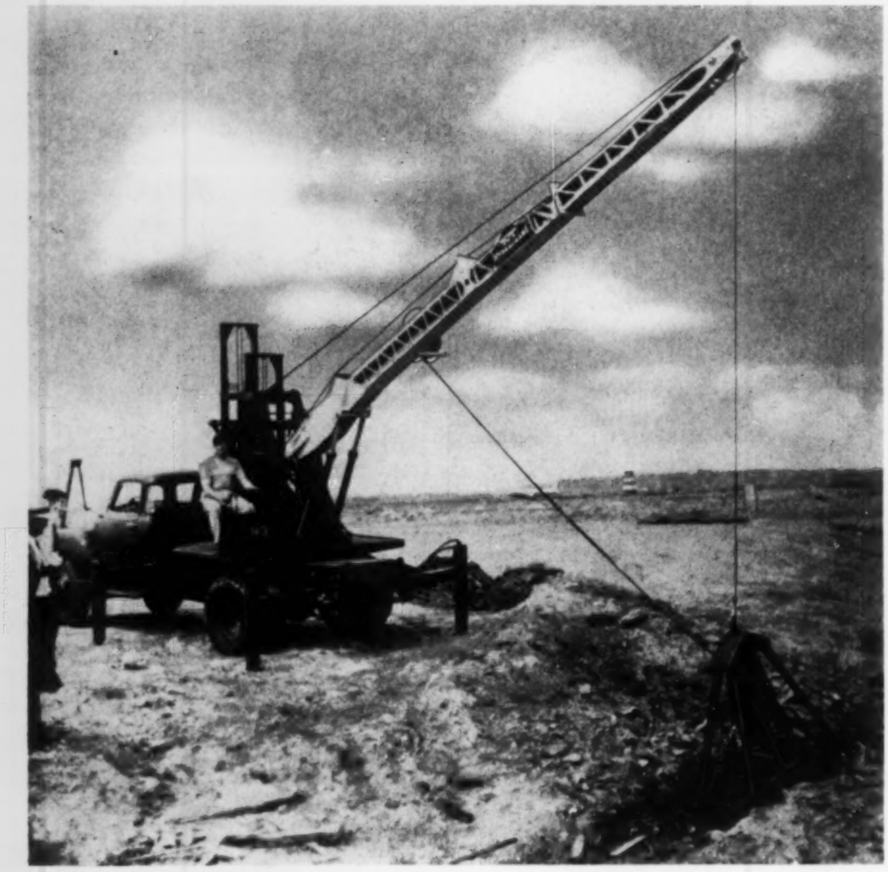
EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

New Model Hydrocrane



Bucyrus-Erie Hydrocrane

A NEW 3-TON capacity Hydrocrane, Model H3, has just been announced by the Hydrocrane Division of Bucyrus-Erie Company. The new unit is designed for the economical handling of small jobs on which the use of a conventional crane-excavator would prove too expensive. Simplicity is a key economy-making characteristic of the Hydrocrane. Full hydraulic operation of the crane (powered by truck engine, governor-controlled to run at the middle of its normal speed range) eliminates shafts, drums, gears, clutches, brakes, chains and sprockets. All functions, including the closing action of the $^{3}/_{8}$-yd clamshell bucket, and the 370° swing, are hydraulically controlled. Operation is easy, because there is no need to synchronize hand and foot motions. Safety is promoted, because there are no clutches or brakes to slip; hydraulic control is positive and precise. Furthermore, it is stated that the nature of hydraulic operation makes the machine almost weatherproof. Lacking clutches or brakes, it operates equally well in 100° and sub-zero temperatures. According to the manufacturer, the 3-ton Model H3 is exceptionally mobile. Supplied as a complete package, factory-mounted on a new motor truck, it can travel at fast highway speeds from one job to the next and set up for work in a hurry on its hydraulic outriggers. A unique feature that is said to boost H3 Hydrocrane field performance is its all-welded box section latticed boom which raises and lowers and telescopes hydraulically. This makes possible fast, accurate spotting of loads and adds to versatility by enabling the operator to reach into box cars, over walls or piling or into buildings. The Hydrocrane is sturdily constructed, with permanently lubricated anti-friction bearings. The H3 weighs 9,375 pounds without truck. When truck-mounted, its overall length in traveling position is 24 feet 6 inches; overall height is 10 feet 6 inches. The manufacturer claims that the unit can provide exceptional service to general contractors, loggers, excavating contractors, pipeline contractors, municipalities, scrap yards, manufacturers, road builders, gravel pit operators, and many others. Further information on how the Hydrocrane operates may be obtained by writing to **Bucyrus-Erie Co., South Milwaukee, Wis.**

Wagon Drill

A NEW THOR WAGON drill features a single reversible pneumatic motor that feeds and raises the drill, eliminating the need of a hoist. The motor-driven feed also permits throttle control that allows the feeding speed of the drill to be reduced when necessary. The drill's mast can be swung 360° vertically or horizontally to permit drilling of holes at any angle. The tubular frame of the rig serves as an air receiver, maintaining a continuous supply of air pressure that eliminates the usual pulsations of the hose line and insures a continuous pressure against the rock bit to prevent steel rebound between blows of the piston hammer. The new Thor drill steel centralizer centers the drill steel with the drifter drill chuck and eliminates difficulty in collaring holes. **Independent Pneumatic Tool Co., Aurora, Ill.**

◆

Truck Tracks

TO BEAT WINTER snow and mud, truck operators may now fit their hauling equipment with crawler-type tracks. These conversion units, known as truck tracks, were formerly channeled to the armed forces. This winter they will be available to private operators everywhere. Designed to add tractor performance to conventional single and tandem axle trucks, truck tracks were tested and approved by U.S. Army Engineers. They permit effective hauling operations under mud, snow and desert conditions which stall ordinary wheeled vehicles. The tracks may be fitted to single or tandem axle trucks equipped with most standard dual tires. Mounting the tracks is a simple operation which takes the driver about 10 minutes.

P & G Truck Tracks

Even less time is required for removal. Pads are made of drop-forged steel alloy. Fitting is done by adding or removing pads and linkage. Every pad has a master adjustment to assure proper track tension. Connecting the pads is a cadmium-plated chain of heat-treated, high-tensile steel. **P & G Supply Co., Portland 14, Ore.**

New Welding Process

At the opening of the National Metal Show, a revolutionary new welding process was introduced to industry. This process is known as the "Aircomatic" process. It may be used for welding heavy sections of aluminum and aluminum alloys at wire feed speeds ranging from 100 to 300 in. per minute permitting deposition rates far exceeding those attained by usual welding methods. A gas-shielded, metal arc method of welding this new process consists of feeding a consumable wire through a manually operated welding "gun." The metals being welded are shielded from the air by an inert gas. According to Air Reduction, as far as it is known, this is the first time that continuous wire feed has been employed for practical welding in the vertical and overhead positions. Argon has been found to be a satisfactory shielding gas for aluminum welding. The welding grade of argon currently supplied for Heliwelding is suitable. For the welding of aluminum, as currently provided in this process, only three sizes of filler metal are needed, 3/64, 1/16 and 3/32 in. With these filler metal sizes the over-all current range is 70–450 amperes which permits welding of metal thicknesses from 1/8 in. up to 2 in. and more. It is anticipated that this sensational new process will have immediate and widespread application throughout industry. **Air Reduction Sales Co., New York, 17, N.Y.**

◆

Electronic Computer

An office size electronic computer, capable of solving intricate industrial and research problems, is now available commercially. The REAC (Reeves Electronic Analogue Computer) has already found extensive uses in many fields of engineering research as well as the architectural and civil engineering fields in the solution of vibration analysis, dynamic structural stress problems, and problems requiring the dynamic solution of simultaneous differential equations. The REAC can actually simulate a structure (bridge, building, tower, etc.), by means of mathematical relationships which are solved as a function of time in response to simulated loads representing winds, moving trucks, trains, etc. As a tester, the REAC is a means of applying varying loads to scale models or typical structural elements. The REAC thus permits rapid and accurate means of arriving at a new optimum structural design without resorting to expensive trial-and-error methods. The REAC consists of twenty amplifiers for summing and integrating. Initial conditions and problem variables are set in on vernier dials that are connected to precision potentiometers. The problem is set up by means of telephone-type patch cords that inter-connect the various amplifier inputs and outputs. The final solution is recorded on a six-channel recorder. **Reeves Instrument Corp., New York, N.Y.**

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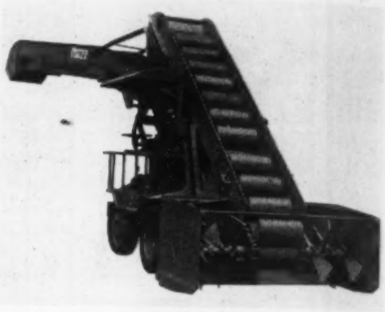
New Swivel Belt Conveyor

A SWIVEL BELT conveyor designed to speed snow removal regardless of traffic conditions is the outstanding feature of Haiss Snow Loader, Model 300 WS-SBC. Swinging through an arc of 22 ft, the swivel conveyor permits snow to be discharged to trucks on either side of the loader. It extends over the highest truck cabs; therefore trucks driving either forward or backward under the conveyor extension can be loaded quickly to full capacity. The loader itself is designed for easy maneuverability so that it can clean up close to parked cars, discharging snow to a truck at either side or rear. The Model 300 WS-SBC has heavy feeding propellers which chop and lift as they dig, a patented Haiss principle for handling wet, dry or hard-frozen snow. The machine has a capacity of 15 to 20 yds per min and can clean 15 to 20 city blocks in a six-hour shift, doing the work of 80 men removing snow by hand shoveling. Streets are cleaned from curb to curb, right down to the pavement. **George Haiss Mfg. Co., Inc., Div. of Pettibone Mulliken Corp., New York, N.Y.**

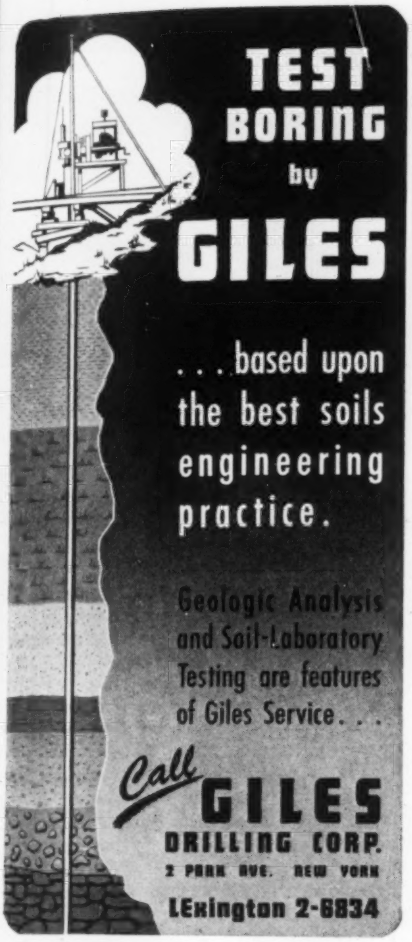


Haiss Swivel Belt Conveyor

◆

Aluminum Vertical Shaft Engine

PRODUCTION IS under way on a new light-weight aluminum Vertical Shaft engine design. Despite its vest-pocket size, $8^1/_2$ in. × $10^1/_2$ in. × 14 in. and weighing only 16 lb, the little motor develops a full horsepower and is ideally suited for application on rotary type lawnmowers, pumps, portable milking machines, small boats, compressors, generators, and many other uses. The use of the 2-stroke principle and light-weight metals, and with special attention given to carburetion and magneto, has enabled the designers to eliminate all unnecessary weight and still produce a sturdy smooth running engine, easy starting, minimum noise and vibration and good operation at any tilt up to 45 deg. The company originally introduced a similar engine with horizontal shaft and contemplates being in production early this year, on a $1^1/_2$ to 2-hp unit. **Power Products Corp., Grafton, Wis.**



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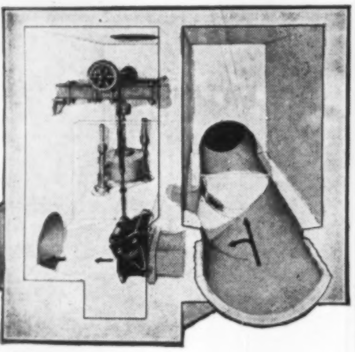

Fig. B-19

Automatic Sewage Regulators control sewage flows either by partially or completely cutting off such flows to suit head or tail water conditions or by "governing" to discharge a predetermined quantity regardless of head or tail water conditions.

Descriptive Bulletins and Engineering Data Available Upon Request.

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Heavy-Duty All-Wheel-Drive Trucks

A NEW LINE of heavy-duty all-wheel-drive converted Ford trucks, identified as the "Q" Series is announced. By utilizing standard Ford components, wherever possible and practical, Marmon-Herrington has taken advantage of the economies of Ford mass-production methods and has succeeded in producing the first heavy-duty all-wheel-drive truck. There are six models in the "Q" Series. Three models are 4-wheel-drive, three models 6-wheel-drive. Gross vehicle weight for 4-wheel-drive models is 21,500 lbs, for 6-wheel-drive models 35,000 lbs. Wheel bases range from 136$^1/_2$ to 220 in. In converting Ford F-7 models to "Q" Series all-wheel-drive trucks, Marmon-Herrington made many changes such as new front driving axle, new two-speed auxiliary transmission of their own design, changed steering assembly and brake connections and a lengthened and reinforced frame. All-wheel-drive trucks have been designed for heavy-duty services which have proved too difficult or impossible for trucks of conventional drive. They have the tremendous tractive power needed to transport peak loads through deepest mud, sand or snow, up steepest hills and mountain grades. They are particularly suited to a wide variety of off-the-road services as snow-removal work, oil field and pipeline work, construction and maintenance of roads, airports, bridges, dams, etc. **Marmon-Herrington Co., Inc., Indianapolis, Ind.**

◆

Portable Crusher

A NEW PORTABLE crushing unit has been introduced by Athey Products Corp. Designed primarily to tow behind the Athey force-feed loader, the new crusher provides a fast and inexpensive means of reclaiming highway pavements. Surfacing materials—black top, concrete and gravel—can be reworked on the site eliminating the necessity for transporting to and from a central crushing plant. The one-man operated unit picks up scarified or broken material from the road, crushes it to any required size and deposits it back on the roadway in one continuous operation. The unit consists of an impact mill powered by a Caterpillar diesel engine, mounted on a two-wheel, rubber-tired trailer. A multiple V-Belt drive connects the engine with the mill. The crusher hopper is fitted with breaker bars which pulverize material and deflect it onto a grid iron preventing the fines from entering the mill. The trailer is equipped with 13.00×24 tires, hydraulic brakes that are synchronized and operated from the force-feed loader brake pedal and fitted with a spring-cushioned, automatic-type hitch coupling providing adequate and essential safety features for matched force-feed loader and crusher unit performance. Plans call for completion of field tests this season and production soon after the first of the year. **Athey Products Corp., Chicago, Ill.**

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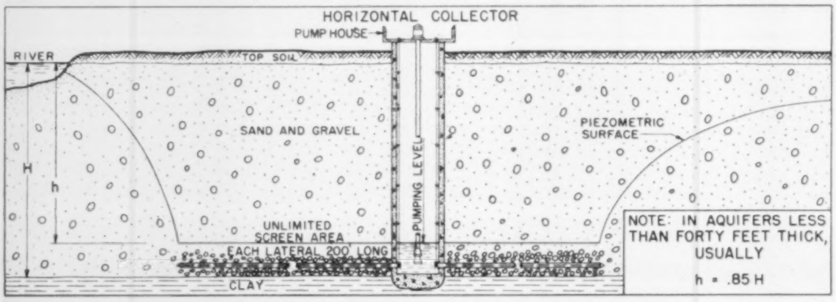

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Literature Available

Waterproofing—An illustrated folder, titled "Specification for Dry Walls," describes processes for waterproofing both above-grade interior wall surfaces and exterior mortar joints of new buildings. It will be of great value to architects, engineers, building owners and others interested in new construction. **Western Waterproofing Co., Syndicate Trust Bldg., St. Louis 1, Mo.**

Concrete Piles and Caissons—Cast-in-place and composite piles are described in a new 12-page, 4-color catalog. Featured are: button-bottom pile, where a precast point is driven to good stratum and a corrugated shell of uniform size for its full depth used as a shaft; pedestal pile, where concrete is driven out of a heavy driving tube to form an enlarged base; caisson pile, with an uncased shaft up to 36 in. dia. Also described are composite and compressed piles. **Western Foundation Corp., 2 Park Ave., New York 16, N.Y.**

Sterelators—The Everson Manufacturing Company offers a 26-page booklet, Bulletin A-1, captioned "Sterelators." It contains information on chlorine feeding equipment for treating public and private water supplies, sewage, swimming pools and industrial purposes. Several pages are dedicated to accessories and auxiliary equipment. With the detailed data the reader will find specifications, diagrams and pictures which are invaluable. **Everson Mfg. Co., 214 W. Huron St., Chicago, Ill.**

Air Meter—A new 6-page folder on determining the air content of fresh concrete by the use of the roll-a-meter is available. Developed by a well-known concrete technician, the roll-a-meter, a precision instrument made of solid bronze is said to be most accurate, utilizing the rolling method for testing for entrained air by washing the air out of the concrete. It is used with a conveniently small size sample of concrete with any type of aggregate without regard to porosity or barometric pressures. The roll-a-meter is also used for making specific gravity tests, mortar tests and aggregate moisture determinations. **Charles R. Watts & Co., 4121 Sixth Ave., N.W., Seattle 7, Wash.**

Steel Forms—How to use steel forms in poured concrete construction is discussed in a new manual, "Steel Forms for Concrete." Intended primarily as an instruction book for engineers, builders and contractors, who will actually use or supervise the use of steel forms, the book contains enough general information to make it invaluable. The booklet tells how to erect, maintain and strip steel forms. It emphasizes the economics and convenience of their use. Methods for difficult situations are thoroughly covered. There are illustrations of the use of Atlas forms in the construction of tunnels, Bridges, caissons, roads, pipes and sewers. **Irvington Form & Tank Corp., Irvington, N.Y.**

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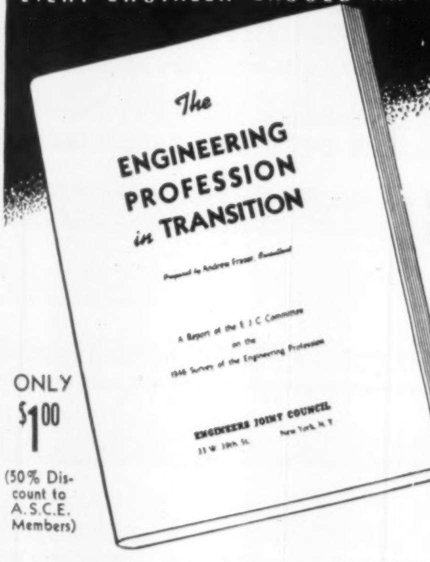
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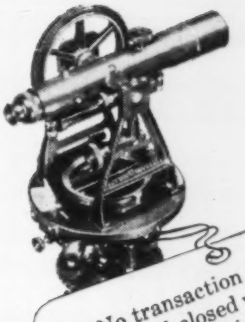

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Literature Available (Cont.)

WIRE ROPE AND SLINGS—Recently published is a new 4-page folder describing stocks of standard wire rope and slings. Huge discounts now being offered by Foster on all quantities of wire rope purchases are mentioned in addition to condition and source. Accompanying the folder is a 12-page inventory booklet which lists the exact quantity in stock, complete description and length of each item, and unit price on the wire rope, wire rope slings and assemblies. **L. B. Foster Co., P.O. Box 1647, Pittsburgh 30, Pa.**

CABLEWAYS—A bulletin with 4 pages of photographs, drawings and descriptive matter, describes the new "Lidgerwood Travelift Cableways": Cableways which eliminate button lines and fall-rope-carriers; which enable loads to be hoisted or lowered as they are being conveyed; which permit the operation of two independently controlled operating lines from the movable cableway carriage; and which attain conveying speeds up to 2400 fpm. **Construction Improvements Limited 67 Yonge St., Toronto, Canada.**

WELL SCREENS—Catalog No. 148 describes the complete line of Johnson welded well screens for wells from 2 to 36 in. dia; screens fabricated of corrosion resistant alloys as well as ferrous metals. The Johnson dewatering well point is also described. The publication contains engineering data on the use and installation of well screens together with useful information on the design of various types of wells. It shows how a properly designed well screen, tailor-made for each installation, increases the efficiency of the well. **Edward E. Johnson, Inc., 2304 Long Ave., St. Paul 4, Minn.**

STEEL BUILDING—Just released is a new, 32-page catalog, Bulletin B-48, on Ideco steel buildings. It describes in detail the many types and applications of buildings that can be easily assembled and erected from standardized, mass-produced special deep ribbed parts. The three principal structural types—self-supporting, rigid frame and mill type—are illustrated and described in complete detail, including specifications and construction features. **International Derrick & Equipment Co., 1315 Pacific, Dallas, Tex.**

CHLORINE—A new 72-page technical manual, "Chlorine," has just been released. Designed for use by operators, technicians, buyers and executives, the new manual presents charts, diagrams and photographic illustrations concerned with the production and handling of chlorine. Safety precautions, shipping, equipment and construction materials receive detailed consideration. The Technical Data section presents a minute study of the properties of chlorine, the preparation and analyses of several bleach liquors and detailed conversion information. Copies may be secured by writing, on business letterhead, to **Columbia Chemical Div. of the Pittsburgh Plate Glass Co., 5th Ave. at Bellefield, Pittsburgh 13, Pa.**

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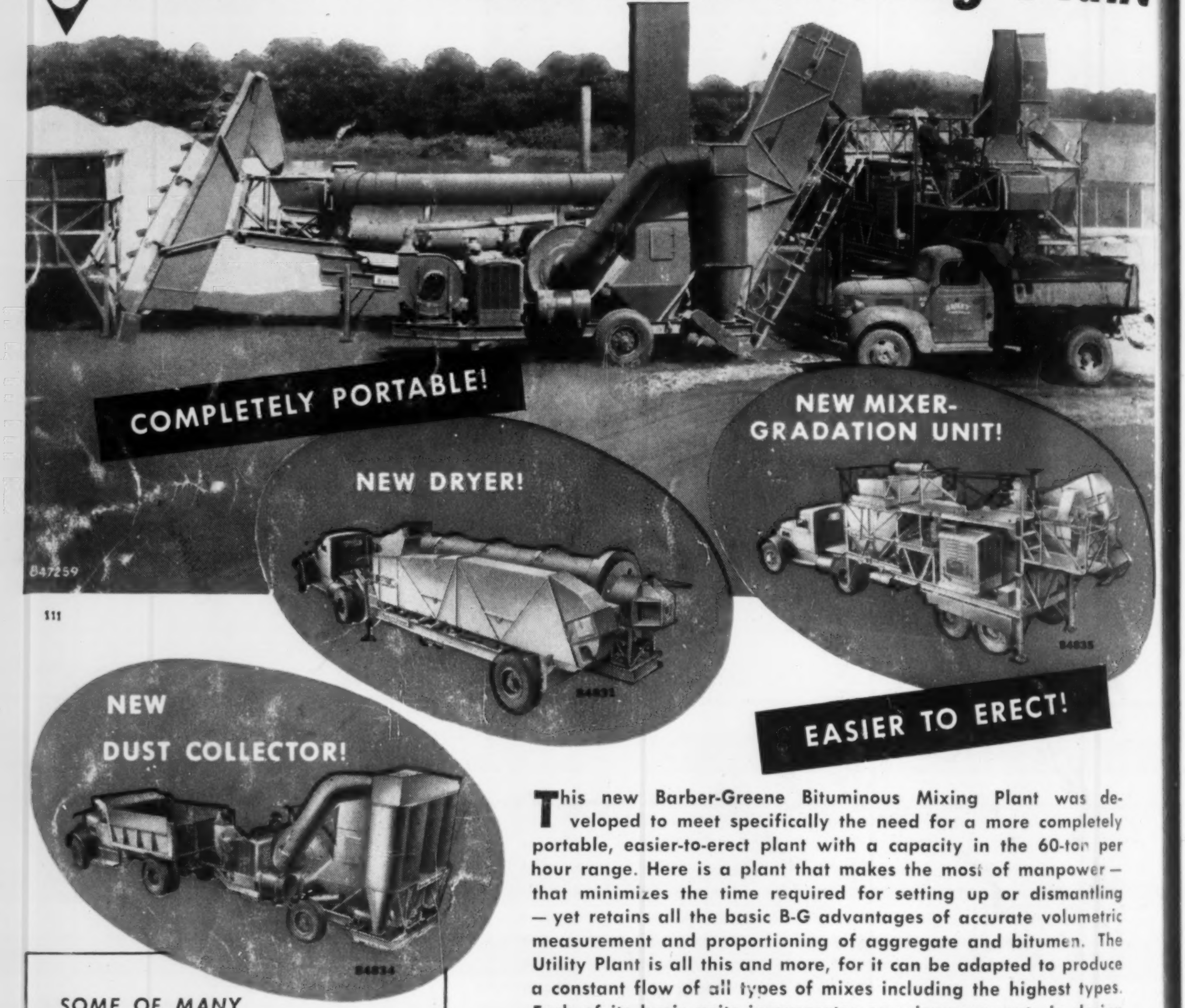
Barber-Greene

B G UTILITY Bituminous Mixing Plant



This new Barber-Greene Bituminous Mixing Plant was developed to meet specifically the need for a more completely portable, easier-to-erect plant with a capacity in the 60-ton per hour range. Here is a plant that makes the most of manpower—that minimizes the time required for setting up or dismantling—yet retains all the basic B-G advantages of accurate volumetric measurement and proportioning of aggregate and bitumen. The Utility Plant is all this and more, for it can be adapted to produce a constant flow of all types of mixes including the highest types. Each of its basic units incorporates new improvements in design to achieve the maximum in portability, simplicity in erection and operation.

Before bidding on any bituminous job, get full information on this new, advanced design Utility Plant. Use the coupon or see your Barber-Greene distributor for your copy of Bulletin 845.

SOME OF MANY REVOLUTIONARY FEATURES!

- *True portability* in every unit
- *Faster erection* without cranes or heavy equipment
- *No cribbing* necessary
- *Adaptability* to widest variety of jobs and mixes
- *Built-in* Gradation Control
- *Built-in* Elevators on Dryer and Mixer
- *High Discharge Dryer*—eliminates hot elevator pit
- *Two, three or four-bin* aggregate gradation

BARBER-GREENE COMPANY
AURORA, ILLINOIS

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